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INTERNATIONAL APPLICATION NO.	INTERNATIONAL FILING DATE	PRIORITY DATE CLAIMED
PCT/US99/20792	September 10, 1999	September 10, 1998
TITLE OF INVENTION		
A SINGLE-CHIP CMOS DIRECT-CONV	ERSION TRANSCEIVER	
APPLICANT(S) FOR DO/EO/US		
MACNALLY et al.		
Applicant herewith submits to the United States		following items and other information:
1. [X] This is a <b>FIRST</b> submission of items of	concerning a filing under 35 U.S.C. 371.	
2. [ ] This is a <b>SECOND</b> or <b>SUBSEQU</b>	<b>JENT</b> submission of items concerning a filing examination procedures (35 U.S.C. 371(f)) at	g under 35 U.S.C. 371.
examination until the expiration of the	applicable time limit set in 35 U.S.C. 371(b) a	and PCT Articles 22 and 39(1)
[X] A proper Demand for International Pre-	eliminary Examination was made by the 19th r	month from the earliest claimed priority date.
[X] A copy of the International Application	n as filed (35 U.S.C. 371(c)(2))	
a. [ ] is transmitted herewith (r	required only if not transmitted by the Internat	ational Bureau).
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5. [ ] A translation of the International A	Application into English (35 U.S.C. 371(c)(2))	i).
E. [X] Amendments to the claims of the Intern	national Application under PCT Article 19 (35	5 H S C 371(a)(3))
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d. [X] have not been made and will r	not be made.	ients nas NO1 expired.
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. [X] An unsigned oath or declaration of the i	inventor(s) (35 U.S.C. 371 (c)(4)).	
0. [ ] A translation of the annexes to the $(25 \text{ H/s } C/271(x)/5))$	International Preliminary Examination Report	rt under PCT Article 36
(35 U.S.C. 371(c)(5)).		
tems 11. to 16. below concern document(s) or  1. [ ] An Information Disclosure Stateme	information included:	
	rding. A separate cover sheet in compliance wi	ith 37 CFR 3.28 and 3.31 is included.
<ol> <li>[X] A FIRST preliminary amendment and a</li> <li>[ ] A SECOND of SUBSEQUENT pre</li> </ol>	ttached Abstract.	
4. [ ] A substitute specification.	VIII.	
5. [ ] A change of power of attorney and/	/or address letter.	!
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	1762720	ATTORNEY'S DOCKET NUMBER 30019.70USWO						
17. [X] The following	g fees are submitted:	CALCULATIONS	PTO USE ONLY					
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Min (Amy) S. Xu MERCHANT & GOU P.O. Box 2903	JLD	NATURE:	ica					
Minneapolis, MN 554	402-0903		NAM	ME: Min (Amy) S. Xu				
		SISTRATION NUMBER: 39,536						

Docket:

MACNALLY et al. 30019.70USWO

Title:

A SINGLE-CHIIP CMOS DIRECT-CONVERSION TRANSCEIVER

#### CERTIFICATE UNDER 37 CFR 1 10

Express Mail' mailing label number: EL658339920US
Date of Deposit February 2, 2001

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National Stage PCT Patent Application: Spec. 16 pgs; 6 claims

The fee has been calculated as shown below in the 'Claims as Filed' table.

16 sheets of formal drawings

An unsigned Combined Declaration and Power of Attorney

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Other: Preliminary Amendment and attached Abstract; courtesy copy of PCT/US99/20792 publication page; International Preliminary Examination Report and annexes; Information Concerning Elected Offices Notified of their Election; Notification of Receipt of Demand; Demand; International Search Report; Notification Concerning Submission of Transmittal of Priority Document; Notice Informing the Applicant of the Communication of the International Application to the Designated Offices; Request

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**CLAIMS AS FILED** 

Number of Claims Filed	In Excess of:	Number Extra	Rate	Fee		
Basic Filing Fee				\$860.00		
Total Claims						
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Independent Claims						
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Initials: MSX:IPD:jjw

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# IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant:

MACNALLY et al.

Serial No.:

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Filing Date:

Concurrent herewith

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30019.70USWO

International

Title:

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A SINGLE-CHIP CMOS DIRECT-CONVERSION TRANSCEIVER

September 10, 1999

Application No.:

Date:

CERTIFICATE UNDER 37 CFR 1.10

'Express Mail' mailing label number: EL658339920US Date of Deposit: February 2001

I hereby certify that this paper or fee is being deposited with the United States Postal Service Express Mail Post Office To Addressee' service under 37 CFR 1.10 on the date indicated above and is addressed to the Assistant Commissioner of Patents and Trademarks, Washington, D.C. 20231.

Name: Brian Maharaj

## PRELIMINARY AMENDMENT

Box PCT Assistant Commissioner for Patents Washington, D. C. 20231

Dear Sir:

In connection with the above-identified application filed herewith, please enter the following preliminary amendment, which is based on claims amended in prosecution of the international application and published in the International Preliminary Examination Report, a copy of which is enclosed herewith:

#### IN THE ABSTRACT

Insert the attached Abstract page into the application as the last page thereof.

#### IN THE SPECIFICATION

A courtesy copy of the present specification is enclosed herewith. However, the World Intellectual Property Office (WIPO) copy should be relied upon if it is already in the U.S. Patent Office.

## REMARKS

A new abstract page is supplied to conform to that appearing on the publication page of the WIPO application, but the new Abstract is typed on a separate page as required by U.S. practice.

Applicants respectfully request that the preliminary amendment described herein be entered into the record prior to calculation of the filing fee and prior to examination and consideration of the above–identified application.

If a telephone conference would be helpful in resolving any issues concerning this communication, please contact Applicants' primary attorney—of record, Min (Amy) S. Xu (Reg. No. 39,536), at (612) 336–4733.

Respectfully submitted,

MERCHANT & GOULD P.C. P.O. Box 2903 Minneapolis, Minnesota 55402–0903 (612) 332–5300

Dated: February 8, 2001

Min (Amy) S. Xu Reg. No. 39,536 MSX:IPD:jjw

# **ABSTRACT**

A single-chip CMOS direct conversion transceiver includes an RF circuit, a transmitter having a synthesizer, a receiver having a baseband filter, and a demodulator.

The synthesizer is coupled to the RF circuit. The baseband filter is coupled to the RF circuit and the synthesizer. The demodulator is coupled to the baseband filter. The RF circuit, the synthesizer, the baseband filter, and the demodulator are arranged and configured in CMOS devices and provide a complete interface between an antenna and a voiceband codec.

# A SINGLE-CHIP CMOS DIRECT-CONVERSION TRANSCEIVER

# **BACKGROUND OF THE INVENTION**

#### 1. Field of the Invention.

This invention relates in general to communication systems, and more particularly to a single-chip CMOS direct-conversion transceiver.

# 2. <u>Description of Related Art.</u>

Today's wireless communications markets are being driven by a multitude of user benefits. Products such as cellular phones, cordless phones, pagers, and the like have freed corporate and individual users from their desks and homes and are driving the demand for additional equipment and systems to increase their utility. As a result digital radio personal communications devices will play an increasingly important role in the overall communications infrastructure in the next decade.

Mixed-signal integration and power management have taken on added

importance now that analog and mixed analog-digital ICs have become the fastestgrowing segment of the semiconductor industry. Integration strategies for
multimedia consoles, cellular telephones and battery-powered portables are being
developed, as well as applications for less integrated but highly specialized building
blocks that serve multiple markets. These building blocks include data converters,
amplifiers and voltage regulators. Makers of amplifiers and regulators often eschew
integration in CMOS, but strive for compact size and reduced costs with
microminiature packaging.

One important aspect of digital radio personal communications devices is the integration of the RF sections of transceivers. Compared to other types of integrated

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circuits, the level of integration in the RF sections of transceivers is still relatively low. Considerations of power dissipation, form factor, and cost dictate that the RF/IF portions of these devices evolve to higher levels of integration than is true at present. Nevertheless, there are some key barriers to realizing these higher levels of integration.

A high level of integration is critical in lowering the cost of electronics for communication systems such as cellular phones, cordless phones, and wireless LANs. Increasing levels of transceiver integration are being reported, e.g., RF, baseband analog, and mixed—signal circuits have been integrated. Further, RF, baseband analog, and voltage—controlled oscillator (VCO) circuits have also been realized in a single die.

It can be seen that there is a need for a fully-integrated transceiver.

It also can be seen that there is a need for a fully-integrated transceiver that incorporates RF circuits, synthesizer, baseband filters, demodulator, and extensive digital control functions.

#### SUMMARY OF THE INVENTION

To overcome the limitations in the prior art described above, and to overcome other limitations that will become apparent upon reading and understanding the present specification, the present invention discloses a single-chip CMOS direct-conversion transceiver.

In one embodiment of the present invention, the single-chip CMOS direct-conversion transceiver includes an RF circuit, a transmitter having a synthesizer, a receiver having a baseband filter, and a demodulator. The synthesizer is coupled to the RF circuit. The baseband filter is coupled to the RF circuit and the synthesizer.

25 The demodulator is coupled to the baseband filter. The RF circuit, the synthesizer,

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the baseband filter, and the demodulator are arranged and configured in CMOS devices and provide a complete interface between an antenna and a voiceband codec.

Another aspect of the invention is that the transceiver further includes a time-division duplex (TDD) circuit for ensuring isolating between the transmitter and the receiver.

A further aspect of the invention is that the transmitter and the receiver share the same RF port which interfaces with an external antenna.

#### BRIEF DESCRIPTION OF THE DRAWINGS

Referring now to the drawings in which like reference numbers represent corresponding parts throughout:

- Fig. 1 illustrates a block diagram of the single-chip CMOS transceiver according to the present invention;
  - Fig. 2 illustrates the low noise amplifier according to the present invention;
- Fig. 3 is a circuit diagram of the mixer and antialias filter according to the present invention;
  - Fig. 4 illustrates a plot of the receiver bit error rate (BER);
  - Fig. 5 is a table illustrating the performance characteristics of the single-chip CMOS transceiver;
    - Fig. 6 illustrates the transmit spectrum for 20 dBm output power;
- Fig. 7 illustrates the voltage controlled oscillator;
  - Fig. 8 illustrates a block diagram of the synthesizer;
  - Fig. 9 is a phase noise plot for the single-chip CMOS transceiver;
  - Fig. 10 is a plot of the unmodulated output spectrum for the single-chip CMOS transceiver;
- 25 Fig. 11 illustrates the measured I/Q constellation for a -80dBm RF input;
  - Fig. 12 illustrates a circuit diagram for the power amplifier;

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Fig. 13 illustrates the die micrograph of the single-chip CMOS transceiver;

Fig. 14 is the intermodulation (IM) plot for the entire receive path;

Fig. 15 shows the measured step response of the channel filters; and

Fig. 16 shows a change in the output levels of the channel filters in response to a change in the amplitude of a receive burst.

#### **DETAILED DESCRIPTION OF THE INVENTION**

In the following description of the exemplary embodiment, reference is made to the accompanying drawings which form a part hereof, and in which is shown by way of illustration the specific embodiment in which the invention may be practiced. It is to be understood that other embodiments may be utilized as structural changes may be made without departing from the scope of the present invention.

In an embodiment of the present invention is a specific combination of building blocks that realize a monolithic transceiver for digital communication that may be used for various media.

A function of the monolithic transceiver is to convert digital data to an analog signal suitable for transmission and to convert a received analog signal into digital data. In practice, there will be a finite bit error rate in the transmission, propagation and reception processes. The specific BER that is tolerable depends on the application. In some cases, the input to one monolithic transceiver and at the output of another monolithic transceiver may be different because of intentional signal processing.

Typically, a pair of monolithic transceivers is used for full duplex communication. However, more than two monolithic transceivers can be used in more complex communication systems. In some cases, the communication is only required from one point to another without full duplex. In some cases, different media may be used for each direction of a full duplex system. In some cases, the

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monolithic transceiver may include multiple receivers and transmitters. In some cases, the analog signal may be converted from one media to another along propagation. Each receiver and transmitter in the monolithic transceiver may be intended for different media.

The digital data communicated may originate from an arbitrary source and will be delivered to an arbitrary target. Common sources and targets include: (1) Computers, (2) Sensors, (3) Magnetic or optical media, (4) Other monolithic transceivers.

The analog signal is typically propagated using one or more of the following methods: (5) Free space radiation, (6) Transmission lines: (a) Coaxial cables, (b) Twisted pairs, (c) Waveguides, (7) Fiber optics, (8) Sonar in liquid, solid or gas media.

The elements used in the monolithic transceiver include the following means:

(9) Digital processing and control circuits, (10) Analog—to—Digital, Analog, Digital—to—Analog processing circuits, (11) Media interface processing circuits.

The digital processing circuits are used to condition data from a source into internal digital data in the monolithic transceiver destined for transmission and to condition received internal digital data in the monolithic transceiver for a target. The digital control circuits are used to coordinate the activities of the monolithic transceiver necessary to accomplish half—duplex, full—duplex or more complex communication systems and to coordinate digital communication with the source and target.

The analog-to-digital, analog and digital-to-analog processing provides the interface between the digital and analog domains. These functions are commonly accomplished using analog circuits such as analog-to-digital converters (ADCs), digital-to-analog converters (DACs), filters and automatic gain control systems. In

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some cases, these functions may be part of or inherent to other analog functions such as a demodulator.

The media interface processing circuits provide the interface between the analog domain used for transmission and the analog domain used in the monolithic transceiver. In a RF monolithic transceiver, these interface circuits include a low noise amplifier (LNA), power amplifier (PA), mixer and synthesizer. Each type of media has its own specific interface circuit appropriate for that media.

More specifically, the monolithic transceiver design includes the following choices: (12) Time division duplex (TD) or frequency division duplex (FDD), (13) Modulation technique, (14) Narrow-band or wide-band communication, (15) Direct-sequence or frequency hopping spreading and despreading, (16) Silicon or heterojunction semiconductor platforms, (17) MOS or bipolar devices.

The specific attributes chosen may ease implementation of the monolithic transceiver that may make the monolithic transceiver particularly attractive for certain markets.

More specifically, the use of silicon MOS technologies permits the monolithic transceiver to take an advantage of attributes of MOS devices in general and to take an advantage of attributes of short—channel MOS devices in modern CMOS technologies for particular wireless applications.

The use of MOS devices permits the digital processing and control circuits to be accomplished with high density and lower power. This is important because of well-known attributes of MOS devices for logic implementation. This permits implementation of sophisticated digital signal processing for portable wireless applications, as an example.

The use of MOS devices permits analog, A/D, D/A processing circuits to be accomplished using switched-capacitor techniques. This is important because, in

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general, MOS devices have the attribute of an extremely large on-state to off-state conductance ratio necessary for an excellent switch. This switch is the basis for sampled-charge based approaches. The use of MOS devices permit a rich and sophisticated array of sampled-data systems to be implemented including ADCs,

5 DACs and filters.

The use of MOS devices permits media interface processing circuits to be accomplished using amplifiers, mixers, and frequency synthesizers. In particular, recent advances in short—channel MOS devices permit the media interface processing circuits to be accomplished at microwave frequencies used in many wireless applications.

More specifically, the use of Bipolar or BiCMOS technology may be used to implement the monolithic transceiver.

The use of BiCMOS technology can be used to accomplish a monolithic transceiver with the digital processing and control circuits using CMOS devices, the analog, A/D, D/A circuits and the media interface processing circuits using a combination of bipolar or CMOS devices.

The use of bipolar technology can be used to accomplish the monolithic transceiver. This approach may be better for specialized applications such as millimeter wave systems where HBT devices are more appropriate. Other applications where bipolar devices may be a better choice include fiber—optic applications.

The use of bipolar devices does not permit the digital processing and control circuits to be accomplished with high density or low power. However, high speed may be the advantage.

The use of bipolar devices does not permit the analog, A/D, D/A circuits to use switched-capacitor techniques. This is a major limitation because of

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sophistication possible with switched—capacitor sampled—data systems. The bipolar device can be used to implement sampled—data systems using other techniques such as switched—current approaches. However, sampled—data systems built with these approaches are far less flexible and use far more power than switched—capacitor techniques.

The use of bipolar devices does permit the media interface processing circuits to be accomplished with more ease at present. However, future advances in CMOS process technology may favor CMOS devices for the media interface processing circuits.

More specifically, the choice of modulation technique influences the complexity of certain blocks. For example, the use of FSK modulation relaxes the linearity requirement of the PA. This is important as at present, CMOS PAs are not easily accomplished with high linearity.

The following description discusses one embodiment of a monolithic transceiver implementation that uses CMOS technology, FSK modulation, switched—capacitor techniques for sampled—data systems and a relatively complex digital signal processor and control unit.

In one embodiment, the present invention provides a single—chip CMOS direct—conversion transceiver. As stated above, a high level of integration is critical in lowering the cost of electronics for communication systems such as cellular phones, cordless phones, and wireless LANs. The present invention provides a fully—integrated transceiver 100, shown in Fig. 1, that incorporates RF circuits 102, 104, synthesizer 106, baseband filters 108, demodulator 110, and digital signal processing. The few off—chip components include an ISM band filter 112, a balun 114, an RF matching network 116, an RC loop filter for the PLL 118, a crystal resonator 120, and a resistor 122 for biasing. The use of a transmit/receive (T/R)

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switch is avoided by sharing a single RF port between a transmitter 124 and a receiver 126. An offset cancellation method attenuates offsets in the baseband without sacrificing bandwidth in the direct conversion receiver 126. Careful circuit, timing, and layout considerations provide isolation between the sensitive RF signal and the digital switching noise. The IC has been fabricated in 0.6–µm CMOS and provides a complete interface between an antenna 128 and a voiceband codec 130.

Architectural and circuit techniques have made it possible to achieve this level of integration without sacrificing performance. Time-division duplex (TDD) ensures isolation between the transmitter 124 and the receiver 126. Direct conversion makes it possible to eliminate expensive, off-chip radio frequency (RF) image reject filters and diplexer, and to replace off-chip intermediate frequency (IF) channel select filters with on-chip low pass filters.

Active on-chip offset reduction by means of feedback and feedforward loops has been combined with a digitally controlled automatic gain control (AGC) circuit 132 that settles within the 160-µs preamble of the receive burst.

In a direct conversion receiver 126, static and varying DC offsets within the base band I and Q channel amplifiers and filters limit the architecture's usefulness. In the past, AC coupling or high pass filtering has been used to remove the DC offset from the signal. However, this removes some of the useful DC or near DC energy from the signal causing degradation to the signal. The present invention uses a combined feedback and feedforward offset cancellation technique with DC signal response to cancel the DC offset problem while at the same time providing for a DC response to the base band signals of interest.

The main feature of the feed forward offset cancellation architecture is its capability to cancel low frequency (DC to 5 kHz) offsets caused by LO leakage and other non-ideal component induced offsets while at the same time maintaining a DC

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response to the signal. This is accomplished by two main components of the architecture.

The first main component is the signal format. A signal format was chosen such that the I and Q base band signals exhibit a positive and negative peak within a certain time frame, 6.66 micro–seconds was chosen. The peaks and valleys of the I and Q signals from one time frame to the next are required to be approximately equal.

The second main component is a positive and negative peak detector which determines the peaks and valleys of the signal over a certain time frame (6.66uS).

The offset is then the addition of the positive and negative peaks divided by two.

A fully-differential analog signal path minimizes supply and substrate noise coupling. To further reduce coupling, transitions of digital signals have been minimized near the sampling edge of baseband switched-capacitor circuits.

Source-coupled logic has been utilized in the PLL frequency dividers to reduce substrate noise injection, while CMOS logic gates have been used in a burst-mode controller (BMC) 134 to achieve low power dissipation and high circuit density. An automatic calibration technique has allowed the integration of a 1.8–GHz LC VCO with a wide tuning range. The receiver 126 has a maximum gain of 106 dB and a sensitivity of –104 dBm.

A low noise amplifier (LNA) 138 and the power amplifier (PA) 104 designs make it possible to share a common RF port 140, thereby eliminating the need for an external transmitter/receiver switch. The transmitter 124 and receiver 126 are attached to the filter/antenna port of a radio transceiver without the need for a costly antenna switch in a time division duplex system.

Radio transceivers usually require both a Low Noise Amplifier or (LNA) for clear reception and a Power Amplifier or (PA) for transmitting over long distances.

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In a time division duplex or (TDD) transceiver 100, the transmitter 124 and receiver 126 are not utilized simultaneously. When the transmitter 124 is on, the receiver 126 is off, and when the receiver 126 is on, the transmitter 124 is off. For a typical TDD transceiver 100, the receive LNA 138 is powered down during the transmit cycle to conserve power, and the transmit power amplifier 140 is powered down while the receiver 126 is on.

In the past, the LNAs and PAs have been designed utilizing bipolar transistor technology. The bipolar LNAs and PA's are capable of powering down, however their respective input and output impedance while in the powered down state do not allow them to be connected together in a TDD system. The powered down LNA will attenuate the output power of the PA and may even be damaged by the PA. The powered down PA will lower the impedance that the LNA "sees" and will attenuate the incoming signal from the antenna.

To get around the varying impedance problem, LNA and PA typically use their own set of different matching components to produce a 50 Ohm LNA input impedance and 50 Ohm PA output impedance. This topology is then combined with an antenna switch so that the off state impedances of either the LNA or the PA will not harm the 50 match achieved by the different matching components. However, the antenna switch can be costly, and the transmit and receive signals are still attenuated somewhat by the switch itself. In addition a control circuit must be used to switch the antenna switch.

According to the present invention, the antenna interface requires only one RF combined input/output port thereby reducing IC package pin count and the number of external components. An impedance transformation network of 25 to 50 ohm network is used to ease the LNA requirement. A singly matched network is used for PA since putting required matching 50 ohm will limit the theoretical power

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efficiency to less than 50% and will degrade the power efficiency achieved in practice.

The LNA 138, shown in Fig. 2, is implemented as a cascade of two stages. The first stage employs a capacitively cross-coupled input pair, M1 and M2, that provides both gain and impedance matching in parallel with a differential pair, M3 and M4, for additional gain. The second stage of the LNA 138 is also a differential pair. All gain stages are loaded by on-chip spiral inductors. The combined LNA gain can be set to 12 dB or 28 dB.

The PA 140 is implemented as a three-stage, class AB amplifier. The first stage is a resistively loaded differential pair, the second stage is a common-source stage loaded with on-chip spiral inductors, and the output stage consists of large open drain devices whose drains are connected to the LNA input. The bias currents of the final stage are provided by off-chip RF chokes. The output power, measured at the balun, can be varied from +2 dBm to +20 dBm. Refer to Fig. 12.

A diagram of a mixer 142 and antialias filter 144 is shown in Fig. 3. The mixer's conversion gain is 14.3 dB. The mixer uses a double balanced structure without a tail current source to increase headroom. Biasing for the RF input transistors is performed by a replica circuit that suppresses transconductance variations with process and temperature. The LO input transistors operate as switches that steer a process and temperature independent current. The output of the mixer 142 is fed to a four—pole Butterworth antialias filter 144 with a cut—off frequency of 2.4 MHz.

Two biquad stages form the four-pole Butterworth antialias filter 144 with a nominal gain of 15.6 dB and a cut-off frequency of 2.4 MHz. Switched-capacitor I and Q baseband filters sample the output of the antialias filter 144 at 24 MHz, attenuate adjacent channels, and provide AGC 132. Each baseband signal path

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comprises a fourth-order low pass Chebyshev filter, implemented with two biquad sections, followed by a group delay equalizer (GDE). The biquads and the GDE have a programmable gain of one or four. The filter is followed by a switched-capacitor variable gain amplifier (VGA) that is programmable with a gain of one, two, or four. This arrangement provides a baseband gain of 0 dB to 48 dB in 6 dB steps.

In a direct conversion receiver 126, LO leakage can lead to large offsets at the inputs to the baseband filters 108. Moreover, offsets in the switched-capacitor filter sections can accumulate and render the output signal undetectable. To overcome this problem, feedback integrators cancel offsets in the first biquad and in the GDE, as shown in Fig. 1. To prevent baseline wander from causing errors, the integrators are placed in a hold mode when data is transferred.

Switched-capacitor peak detector circuits 146 sample the maximum and minimum values of the filtered I and Q signals. The AGC controller 132 uses the peak detector 146 outputs to estimate the signal levels and adjusts the baseband gain accordingly. The outputs of the peak detectors 146 are also low pass filtered to estimate the residual offset in the outputs of the channel filters. The offset is then subtracted from the baseband filter output, and the resulting I and Q signals are fed to the BFSK demodulator 110.

The BFSK demodulator 110 is implemented with switched-capacitor circuits clocked at 6 MHz. It generates a digital output based on the direction of rotation of the I/Q constellation. The digital output of the demodulator 110 is processed by the on-chip BMC 134, comprising over 8000 CMOS standard cell gates, that performs clock recovery and direct sequence spreading and despreading. The receiver bit error rate (BER), shown in Fig. 4, illustrates the receiver sensitivity. Selectivity and blocking performance are given in the table in Fig. 5.

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The single frequency synthesizer 106 creates both LO and PA input signals for receive and transmit, respectively. The circuit generates channels from 900 MHz to 930 MHz in 750kHz increments. During receiving, a divide—by—two circuit creates I and Q LO signals form the output of a VCO operating at twice the desired frequency in a high bandwidth PLL. During transmit, the PLL bandwidth is reduced allowing filtered transmit data to directly modulate the VCO while maintaining a constant center frequency. The transmit spectrum for 20 dBm output power is shown in Fig. 6. The VCO, shown in Fig. 7, is designed as a cross—coupled differential pair loaded by spiral inductors and by capacitors. The load capacitors include ac—coupled channel varactors, modulation varactors, and a bank of capacitors for automatic coarse frequency adjustment.

The synthesizer 106 architecture is shown in Fig. 8. The varactors are on chip. The VCO 148 operates at twice the carrier frequency in order to alleviate problems arising from PA pulling. Furthermore, it allows the robust creation of I and Q signals using a simple divide—by—two circuit. A phase noise plot is provided in Fig. 9, and the output spectrum is shown in Fig. 10.

The VCO 148 is automatically calibrated in a closed loop with control circuitry that digitally adjusts the capacitive load of the tank. The measured I/Q constellation for a -80dBm RF input is shown in Fig. 11. The PA circuit 140 is illustrated in Fig. 12. The power efficiency of the PA 140 is 20% at +20 dBm.

The measured performance, summarized in the table of Fig. 5, demonstrates that a single-chip CMOS transceiver 100 can successfully integrate the RF front end along with baseband analog circuits and a significant amount of standard cell digital circuits. Fig. 13 illustrates the die micrograph of the single-chip CMOS transceiver 100.

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The intermodulation (IM) plot for the entire receive path is shown in Fig. 14. This plot was generated by applying two tones that are 6 channels away from the carrier and recording the power of the IM product at the output of the baseband filters. The tones were chosen such that the IM products are well within the bandwidth of the baseband filters 108. The measurements include the influence of on-chip test buffers on the receiver linearity. The input signal power was measured at the input to the chip, and the LNA gain was in its "high" settings. The 1-dB compression point is limited by the switched-capacitor circuits and occurs at approximately 5V differential amplitude.

All switched-capacitor stages in the baseband filters 108, peak detectors 146, and demodulator 110 employ correlated double sampling (CDS) to attenuate their offsets and 1/f noise. To minimize offsets due to mismatch in sampling switches, NMOS rather than CMOS switches have been used. The four clock signals include two-phase, non-overlapping and delayed phases that are driven by voltage doublers. Static charge pumps drive the gain selection switches in the baseband filters 108 and VGA. Fig. 15 shows the measured step response of the channel filters. Fig. 16 shows a change in the output levels of the channel filters in response to a change in the amplitude of a receive burst.

The selectivity, as shown in the table of Fig. 5, was measured by applying a -83 dBm desired signal, then increasing the power of an interferer until the BER reached 10<sup>-3</sup>. The difference between the power of the interferer and -83 dBm is the selectivity. This test was performed with the interferer within the desired channel as well as 1.5 MHz, 3 MHz, and 4.5 MHz from the carrier. When the interfering tone is 4.5 MHz from the carrier, the receiver's BER is limited by the linearity of the front end. Hence, this measurement represents the blocking performance of the receiver 25 126.

The foregoing description of the exemplary embodiment of the invention has been presented for the purposes of illustration and description. It is not intended to be exhaustive or to limit the invention to the precise form disclosed. Many modifications and variations are possible in light of the above teaching.

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## What is claimed is:

- A single-chip direct conversion transceiver, comprising:
   an RF circuit;
  - a transmitter having a synthesizer;
- a receiver having a baseband filter and a demodulator; and wherein the synthesizer is coupled to the RF circuit, the baseband filter is coupled to the RF circuit, and the demodulator is coupled to the baseband filter.
- 10 2. The transceiver of claim 1, further comprising a time-division duplex (TDD) circuit for ensuring isolating between the transmitter and the receiver.
  - 3. The transceiver of claim 1, wherein the transmitter and the receiver share the same RF port which interfaces with an external antenna.
  - 4. The transceiver of claim 1, wherein the synthesizer performs FSK modulation.
  - 5. A single-chip direct conversion receiver, comprising: an RF circuit;
  - a baseband filter and a demodulator; and
    wherein the baseband filter is coupled to the RF circuit, and the
    demodulator is coupled to the baseband filter.
- 25 6. The receiver of claim 5, wherein the demodulator performs FSK modulation.

## **PCT**

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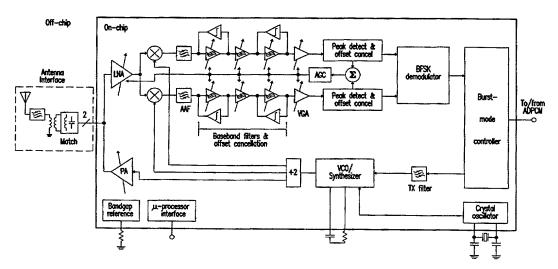
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#### (57) Abstract

A single-chip CMOS direct conversion transceiver includes an RF circuit, a transmitter having a synthesizer, a receiver having a baseband filter, and a demodulator. The synthesizer is coupled to the RF circuit. The baseband filter is coupled to the RF circuit and the synthesizer. The demodulator is coupled to the baseband filter. The RF circuit, the synthesizer, the baseband filter, and the demodulator are arranged and configured in CMOS devices and provide a complete interface between an antenna and a voiceband codec.

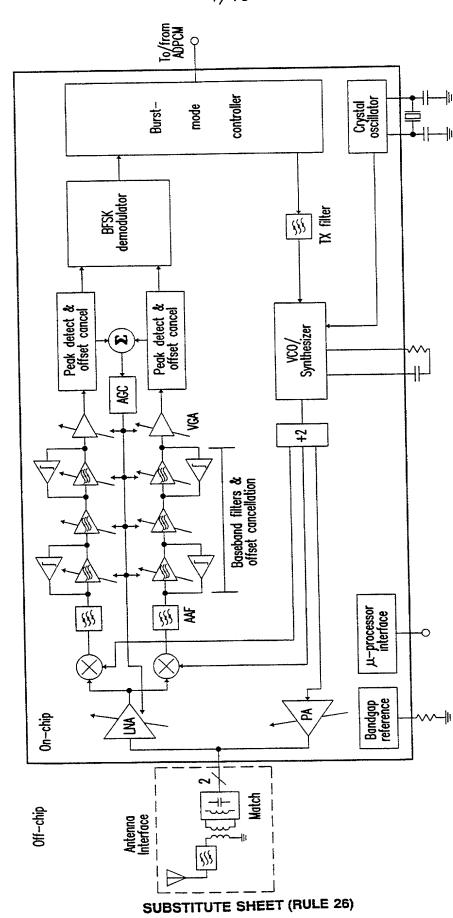
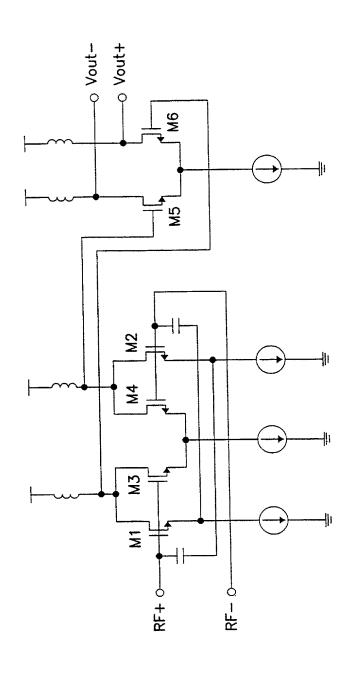
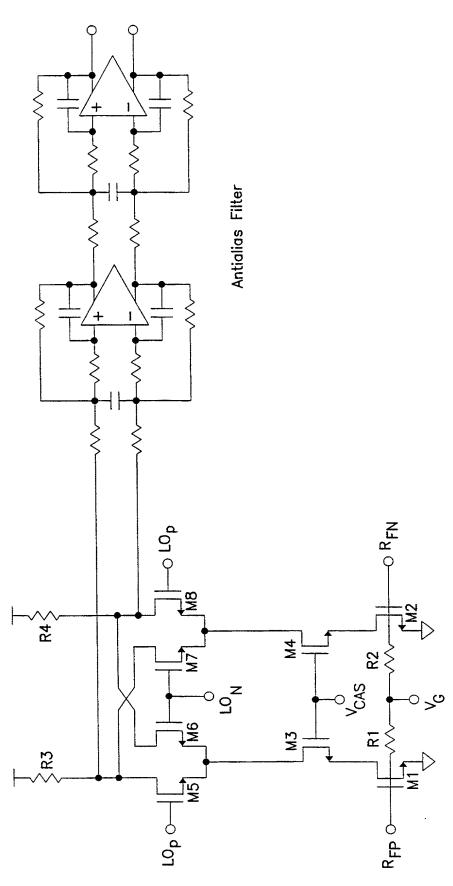


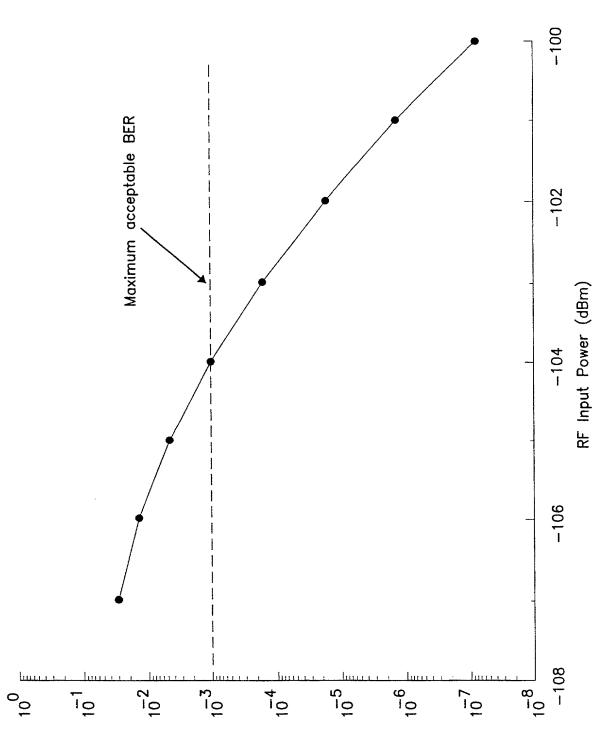
FIG.





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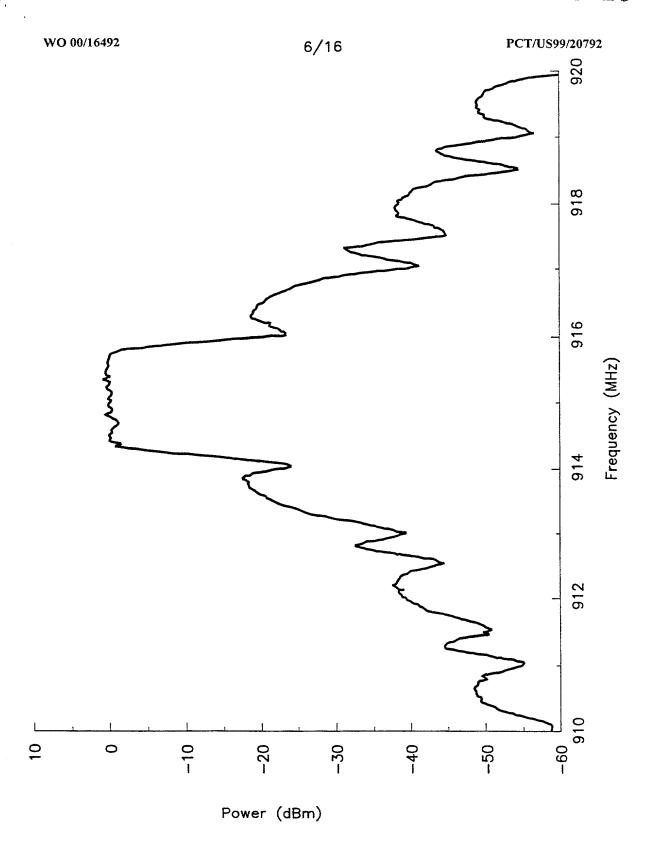
Bit Error Rate

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	-104dBm	110dB	4.5dB	+22dBm	~21dBm	3dB, 23dB, 57dB Hz)	8P29	525mW		2, 8, 14, 20dBm	1.5MHz	±1%	2dBm) 254mW		0.6-jum 2P3M CMOS	5 4mm × 6 7mm
Receiver	Sensitivity	Dynamic Range	Noise figure (DSB)	IIP2 (high gain)	IIP3 (high gain)	Selectivity (co-channel, 1.5MHz, 3MHz)	Blocking (4.5MHz)	Power dissipation (3.3V)	Transmitter	Output power (into $50\Omega$ )	Bandwidth	Modulation accuracy	Power dissipation (3.3V, 2dBm)	General	Technology	Die gred

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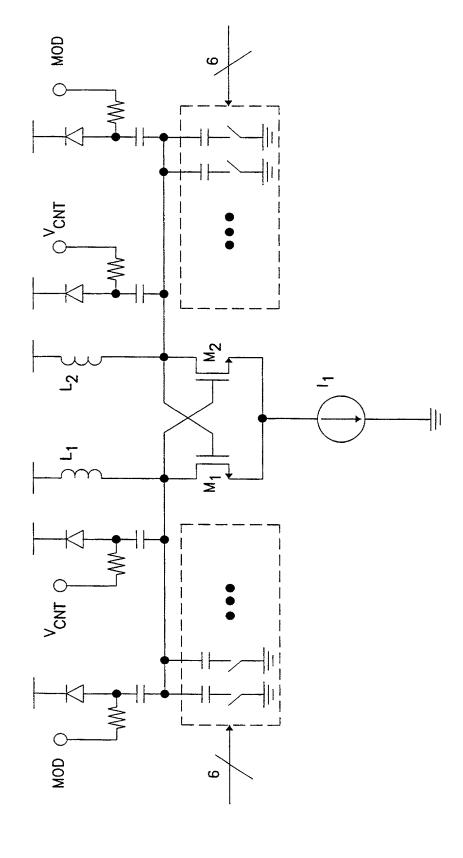
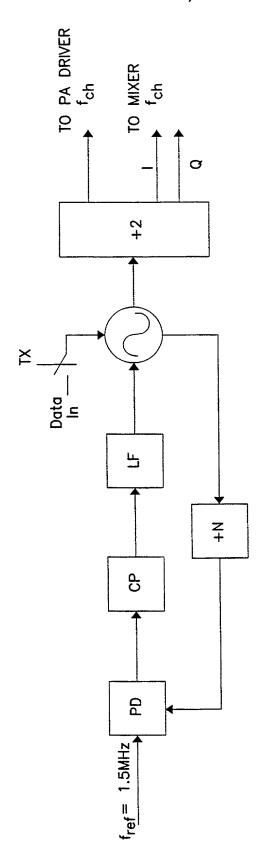


FIG.



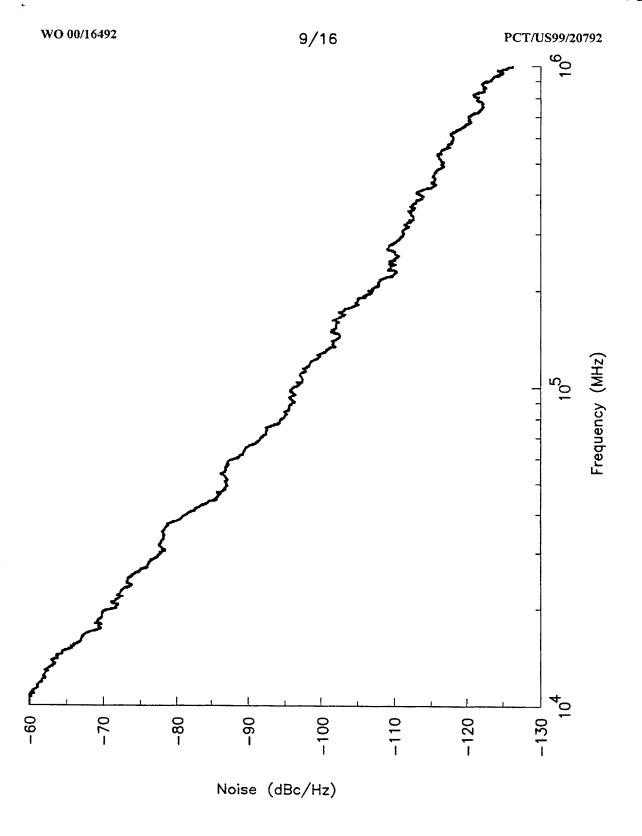
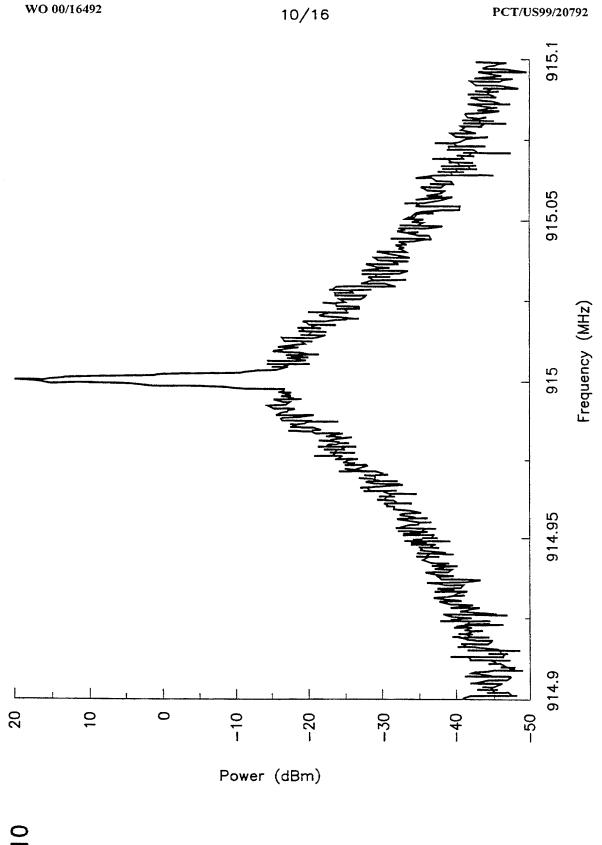
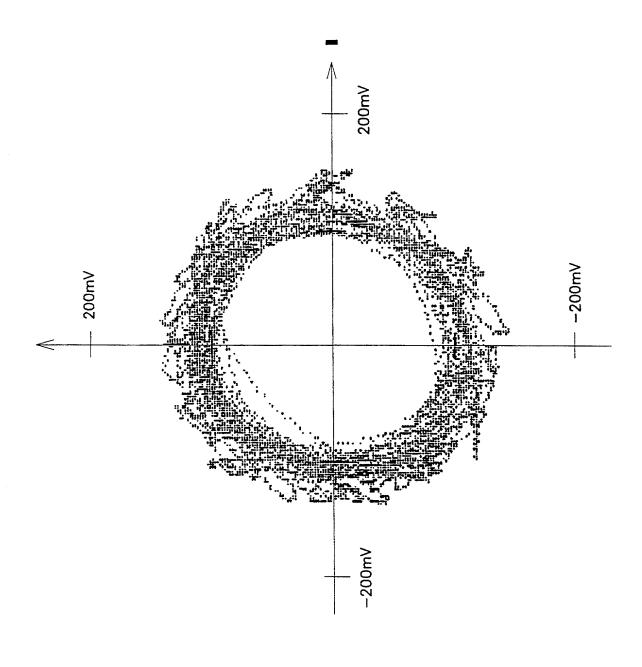


FIG. 9



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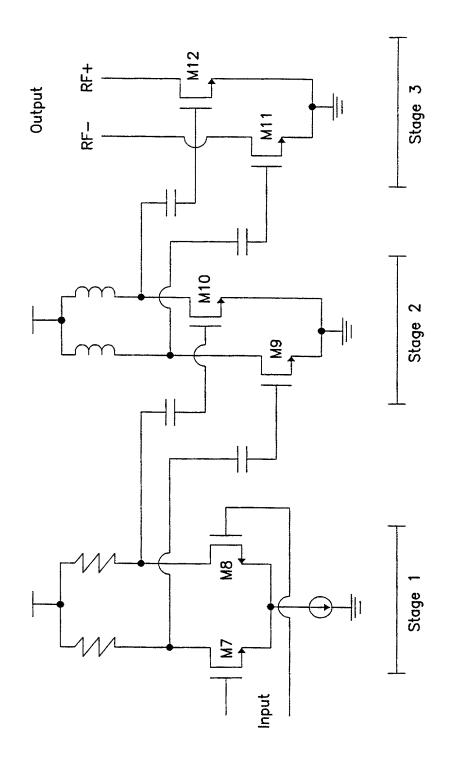
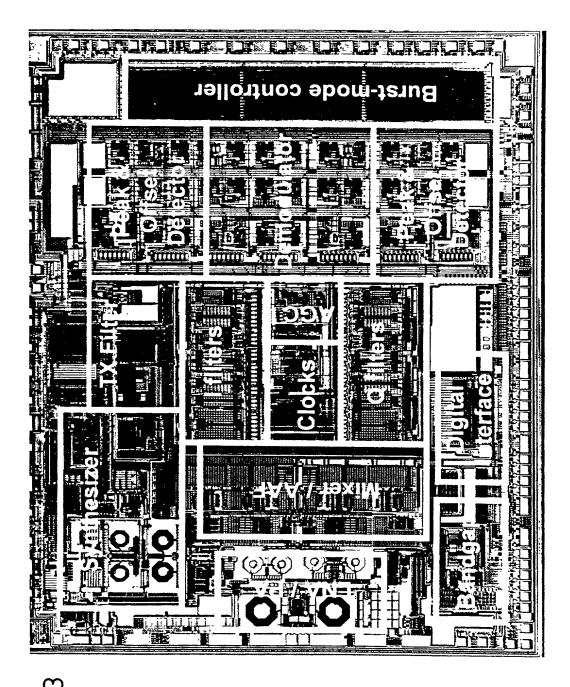


FIG. 12



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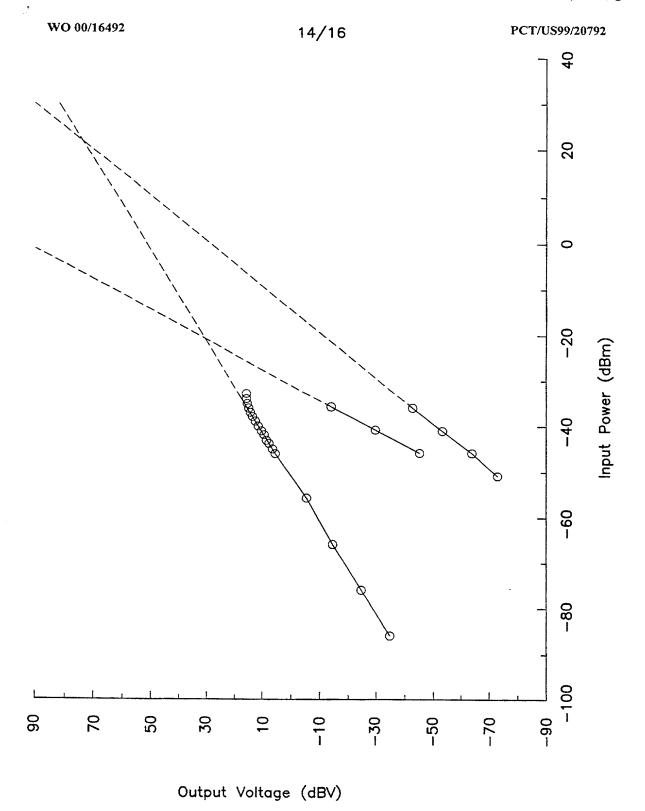
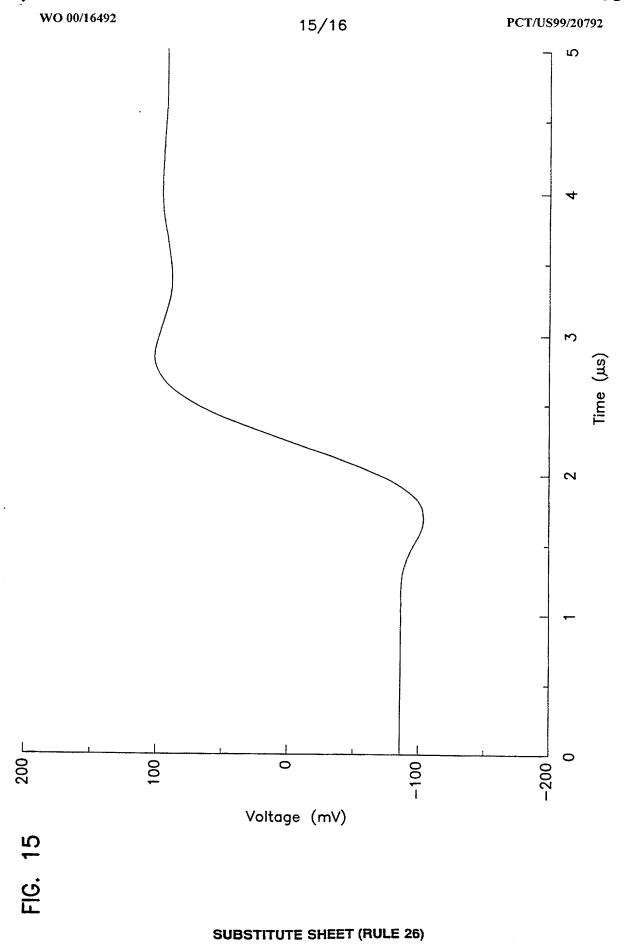
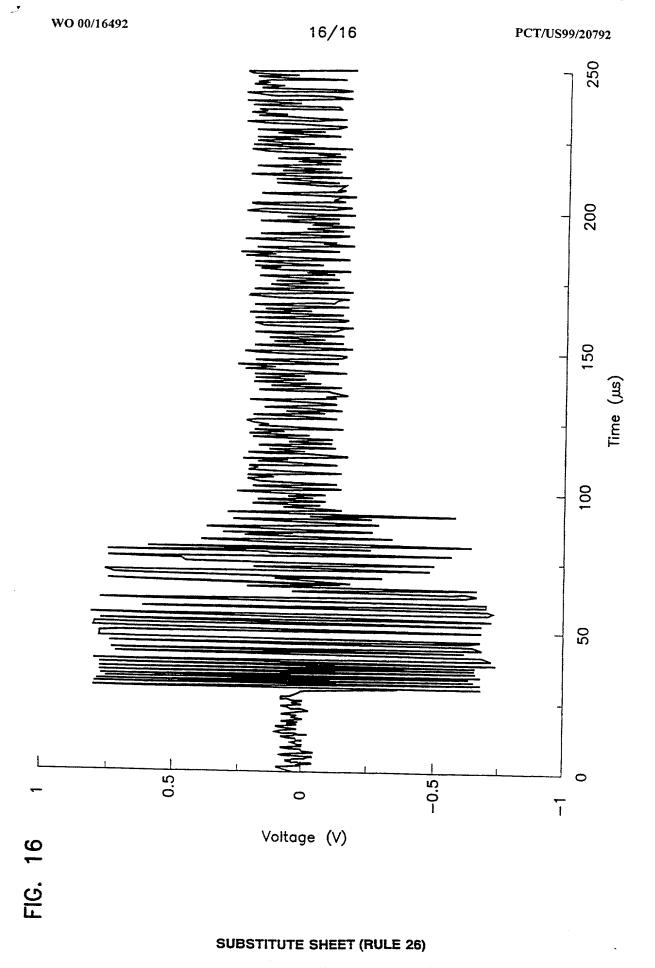
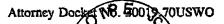


FIG. 14

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### MERCHANT & GOULD P.C.

### **United States Patent Application**

### COMBINED DECLARATION AND POWER OF ATTORNEY

As a blow named inventor I hereby declare that: my residence, post office address and citizenship are as stated below next to my name; that

I verily believe I am the original, first and sole inventor (if only one name is listed below) or a joint inventor (if plural inventors are named below) of the subject matter which is claimed and for which a patent is sought on the invention entitled: A SINGLE-CHIP CMOS DIRECT-CONVERSION TRANSCEIVER

The	speci	fication	of	which
***				

a. is attached hereto

b. Was filed on February 8, 2001 as application serial no. 09/762,720 and was amended on (if applicable) (in the case of a PCT-filed application) described and claimed in international no. PCT/US99/20792 filed September 10, 1999, and as amended on September 27, 2000 (if any), which I have reviewed and for which I solicit a United States patent.

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to the patentability of this application in accordance with Title 37, Code of Federal Regulations, § 1.56 (attached hereto).

I hereby claim foreign priority benefits under Title 35, United States Code, § 119/365 of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on the basis of which priority is claimed:

a. X no such applications have been filed.

b. such applications have been filed as follows:

21	FOREIGN APPLICATION(S), IF ANY	, CLAIMING PRIORITY UNDER	35 USC § 1.19
COUNTRY	APPLICATION NUMBER	DATE OF FILING (day, month, year)	DATE OF ISSUE (day, month, year)
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COUNTRY	APPLICATION NUMBER	DATE OF FILING (day, month, year)	DATE OF ISSUE (day, month, year)
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I hereby claim the benefit under Title 35, United States Code, § 120/365 of any United States and PCT international application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application the manner provided by the first paragraph of Title 35, United States Code, § 112, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, § 1.56(a) which occurred between the filing date of the prior property and the national or PCT international filing date of this application.

U.S. APPLICATION NUMBER	DATE OF FILING (day, mouth, year)	STATUS (patented, pending, abandoned)

U.S. PROVISIONAL APPLICATION NUMBER	DATE OF FILING (Day, Month, Year)
60/099,723	10 September 1998

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I hereby appoint the following attorney(s) and/or patent agent(s) to prosecute this application and to transact all business in the Patent and Trademark Office connected herewith:

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Black, Bruce E.         Reg. No. 41,622         McIntyre, Jr., William F.         Reg. No. 44           Branch, John W.         Reg. No. 41,633         Mitchem, M. Todd         Reg. No. 40           Bremer, Dennis C.         Reg. No. 40,528         Mueller, Douglas P.         Reg. No. 30           Bruess, Steven C.         Reg. No. 32,404         Nichols, A. Shane         Reg. No. 40           Byrne, Linda M.         Reg. No. 46,597         Pauly, Daniel M.         Reg. No. 40           Campbell, Keith         Reg. No. 25,959         Phillips, Bryan K.         Reg. No. 40           Carlson, Alan G.         Reg. No. 33,227         Phillips, John B.         Reg. No. 37           Chiapetta, James R.         Reg. No. 30,247         Pyrel, Melissa J.         Reg. No. 46           Clifford, John A.         Reg. No. 30,247         Pyrel, Melissa J.         Reg. No. 41           Coldren, Richard J.         Reg. No. 44,084         Qualey, Terry         Reg. No. 25           Daignault, Ronald A.         Reg. No. 34,994         Reiland, Barl D.         Reg. No. 37           Daley, Demnis R.         Reg. No. 40,579         Roberts, Fred         Reg. No. 43           Daulton, Julie R.         Reg. No. 42,157         Roberts, Fred         Reg. No. 39           DeVries Smith, Katherine M.         Reg. No. 28,707	921 731 300 836 364 123 990 206 068 512 148 703 767
Branch, John W.         Reg. No. 41,633         Mitchem, M. Todd         Reg. No. 40,528           Bremer, Dennis C.         Reg. No. 40,528         Mueller, Douglas P.         Reg. No. 30.           Bruess, Steven C.         Reg. No. 34,130         Nichols, A. Shane         Rcg. No. 43.           Byrne, Linda M.         Reg. No. 32,404         Parsons, Nancy J.         Reg. No. 40.           Campbell, Keith         Reg. No. 32,959         Pauly, Daniel M.         Reg. No. 40.           Carlson, Alan G.         Reg. No. 33,227         Phillips, Bryan K.         Rcg. No. 46.           Caspers, Philip P.         Reg. No. 39,634         Prendergast, Paul         Reg. No. 46.           Clifford, John A.         Reg. No. 30,247         Pytel, Melissa J.         Reg. No. 46.           Clifford, John A.         Reg. No. 40,844         Qualey, Terry         Reg. No. 25.           Daignault, Ronald A.         Reg. No. 25,968         Reich, John C.         Reg. No. 25.           Dalglish, Leslie E.         Reg. No. 34,994         Reiland, Earl D.         Reg. No. 25.           Daulton, Julie R.         Reg. No. 36,414         Samuels, Lisa A.         Reg. No. 39.           DeVries Smith, Katherine M.         Reg. No. 28,707         Schuman, Mark D.         Reg. No. 39.           Edell, Robert T.         Reg. No. 2	731 300 836 364 123 990 206 068 512 148 703 767
Bremer, Dennis C.         Reg. No. 40,528         Mueller, Douglas P.         Reg. No. 30, 30, 34, 130           Bruess, Steven C.         Reg. No. 34,130         Nichols, A. Shane         Rcg. No. 43, 32, 404           Byrne, Linda M.         Reg. No. 32,404         Parsons, Nancy J.         Reg. No. 40, 40, 40           Campbell, Keith         Reg. No. 46,597         Pauly, Daniel M.         Reg. No. 40, 40           Carlson, Alan G.         Reg. No. 25,959         Phillips, Bryan K.         Rcg. No. 40           Caspers, Philip P.         Reg. No. 39,634         Prendergast, Paul         Reg. No. 37           Chiapetta, James R.         Reg. No. 39,634         Prendergast, Paul         Reg. No. 46           Clifford, John A.         Reg. No. 30,247         Pyrel, Melissa J.         Reg. No. 41           Coldren, Richard J.         Reg. No. 44,084         Qualey, Terry         Reg. No. 25           Daignault, Ronald A.         Reg. No. 25,968         Reich, John C.         Reg. No. 37           Daley, Dennis R.         Reg. No. 34,994         Reiland, Earl D.         Reg. No. 35           Dalglish, Leslie E.         Reg. No. 40,579         Roberts, Fred         Reg. No. 34           Daulton, Julie R.         Reg. No. 36,414         Samuels, Lisa A.         Reg. No. 39           DiPietro, Mark J. <t< td=""><td>300 836 364 123 990 206 068 512 148 703 767</td></t<>	300 836 364 123 990 206 068 512 148 703 767
Bruess, Steven C.         Reg. No. 34,130         Nichols, A. Shane         Reg. No. 43           Byrne, Linda M.         Reg. No. 32,404         Parsons, Nancy J.         Reg. No. 40           Campbell, Keith         Reg. No. 46,597         Pauly, Daniel M.         Reg. No. 40           Carlson, Alan G.         Reg. No. 25,959         Phillips, Bryan K.         Rcg. No. 46           Caspers, Philip P.         Reg. No. 33,227         Phillips, John B.         Reg. No. 37           Chiapetta, James R.         Reg. No. 39,634         Prendergast, Paul         Reg. No. 46           Clifford, John A.         Reg. No. 30,247         Pytel, Melissa J.         Reg. No. 46           Coldren, Richard J.         Reg. No. 44,084         Qualey, Terry         Reg. No. 25           Daignault, Ronald A.         Reg. No. 25,968         Reich, John C.         Reg. No. 37           Daley, Demais R.         Rcg. No. 34,994         Rciland, Earl D.         Reg. No. 25           Dallish, Leslie E.         Reg. No. 40,579         Roberts, Fred         Reg. No. 34           Daulton, Julie R.         Reg. No. 36,414         Samuels, Lisa A.         Reg. No. 39           DeVries Smith, Katherine M.         Reg. No. 42,157         Schuman, Mark D.         Reg. No. 39           DiPietro, Mark J.         Reg. No. 28,707	836 364 123 990 206 068 512 148 703 767 707
Byrne, Linda M.         Reg. No. 32,404         Parsons, Nancy J.         Reg. No. 40           Campbell, Keith         Reg. No. 46,597         Pauly, Daniel M.         Reg. No. 40           Carlson, Alan G.         Reg. No. 25,959         Phillips, Bryan K.         Rcg. No. 46           Caspers, Philip P.         Reg. No. 33,227         Phillips, John B.         Reg. No. 37           Chiapetta, James R.         Reg. No. 39,634         Prendergast, Paul         Reg. No. 46           Clifford, John A.         Reg. No. 30,247         Pytel, Melissa J.         Reg. No. 41           Coldren, Richard J         Reg. No. 40,084         Qualcy, Terry         Reg. No. 25           Daignault, Ronald A.         Reg. No. 25,968         Reich, John C.         Reg. No. 37           Daley, Dennis R.         Rcg. No. 34,994         Reidand, Earl D.         Reg. No. 25           Dalglish, Leslie E.         Reg. No. 40,579         Roberts, Fred         Reg. No. 34           Daulton, Julie R.         Reg. No. 36,414         Samuels, Lisa A.         Reg. No. 39           DeVries Smith, Katherine M.         Reg. No. 28,707         Schuman, Mark D.         Reg. No. 39           DiPietro, Mark J.         Reg. No. 20,187         Schuman, Mark D.         Reg. No. 31           Edell, Robert T.         Reg. No. 39,667	364 123 990 206 068 512 148 703 767 707
Campbell, Keith         Reg. No. 46,597         Pauly, Daniel M.         Reg. No. 40           Carlson, Alan G.         Reg. No. 25,959         Phillips, Bryan K.         Rcg. No. 46           Caspers, Philip P.         Reg. No. 33,227         Phillips, John B.         Reg. No. 37           Chiapetta, James R.         Reg. No. 39,634         Prendergast, Paul         Reg. No. 46           Clifford, John A.         Reg. No. 30,247         Pytel, Melissa J.         Reg. No. 41           Coldren, Richard J         Reg. No. 44,084         Qualey, Terry         Reg. No. 25           Daignault, Ronald A.         Reg. No. 25,968         Reich, John C.         Reg. No. 37           Daley, Dennis R.         Rcg. No. 34,994         Reiland, Barl D.         Reg. No. 25           Dalglish, Leslie B.         Reg. No. 40,579         Roberts, Fred         Reg. No. 34           Daulton, Julie R.         Reg. No. 42,157         Roberts, Lisa A.         Reg. No. 43           DeVrics Smith, Katherine M.         Reg. No. 42,157         Schuman, Mark D.         Reg. No. 39           DiPietro, Mark J.         Reg. No. 28,707         Schuman, Mark D.         Reg. No. 39           Edell, Robert T.         Reg. No. 39,667         Schuman, Michael D.         Reg. No. 31           Epp Ryan, Sandra         Reg. No. 40,620	123 990 206 068 512 148 703 767 707
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Caspers, Philip P.         Reg. No. 33,227         Phillips, John B.         Reg. No. 37           Chiapetta, James R.         Reg. No. 39,634         Prendergast, Paul         Reg. No. 46           Clifford, John A.         Reg. No. 30,247         Pytel, Melissa J.         Reg. No. 41           Coldren, Richard J         Reg. No. 44,084         Qualcy, Terry         Reg. No. 25           Daignault, Ronald A.         Reg. No. 25,968         Reich, John C.         Reg. No. 37           Daley, Dennis R.         Rcg. No. 34,994         Reiland, Earl D.         Reg. No. 25           Dalglish, Leslie E.         Reg. No. 40,579         Roberts, Fred         Reg. No. 34           Daulton, Julie R.         Reg. No. 36,414         Samuels, Lisa A.         Reg. No. 43           De Vrices Smith, Katherine M.         Reg. No. 42,157         Schumat, David G.         Reg. No. 39           DiPietro, Mark J.         Reg. No. 28,707         Schuman, Mark D.         Rcg. No. 31           Edell, Robert T.         Reg. No. 20,187         Schumann, Michael D.         Reg. No. 30           Epp Ryan, Sandra         Reg. No. 39,667         Scull, Timothy B.         Reg. No. 42           Glance, Robert J.         Reg. No. 40,620         Sebald, Gregory A.         Reg. No. 40           Goggin, Matthew J.         Reg. No. 26,896<	206 068 512 148 703 767 707
Chiapetta, James R.         Reg. No. 39,634         Prendergast, Paul         Reg. No. 46           Clifford, John A.         Reg. No. 30,247         Pytel, Melissa J.         Reg. No. 41           Coldren, Richard J         Reg. No. 44,084         Qualey, Terry         Reg. No. 25           Daignault, Ronald A.         Reg. No. 25,968         Reich, John C.         Reg. No. 37           Daley, Dennis R.         Reg. No. 34,994         Reiland, Earl D.         Reg. No. 25           Dalglish, Leslie B.         Reg. No. 40,579         Roberts, Fred         Reg. No. 34           Daulton, Julie R.         Reg. No. 36,414         Samuels, Lisa A.         Reg. No. 43           DeVrices Smith, Katherine M.         Reg. No. 42,157         Schumaltz, David G.         Reg. No. 39           DiPietro, Mark J.         Reg. No. 28,707         Schuman, Mark D.         Reg. No. 31           Edell, Robert T.         Reg. No. 20,187         Schumann, Michael D.         Reg. No. 30           Epp Ryan, Sandra         Reg. No. 39,667         Scull, Timothy B.         Reg. No. 32           Glance, Robert J.         Reg. No. 40,620         Sebald, Gregory A.         Reg. No. 40           Goggin, Matthew J.         Reg. No. 26,896         Spellman, Steven J.         Reg. No. 45	068 512 148 703 767 707
Clifford, John A.         Reg. No. 30,247         Pytel, Melissa J.         Reg. No. 41           Coldren, Richard J         Reg. No. 44,084         Qualcy, Terry         Reg. No. 25           Daignault, Ronald A.         Reg. No. 25,968         Reich, John C.         Reg. No. 37           Daley, Dennis R.         Rcg. No. 34,994         Reiland, Earl D.         Reg. No. 25           Dalglish, Leslie E.         Reg. No. 40,579         Roberts, Fred         Reg. No. 34           Daulton, Julie R.         Reg. No. 36,414         Samuels, Lisa A.         Reg. No. 43           DeVries Smith, Katherine M.         Reg. No. 42,157         Schumaltz, David G.         Reg. No. 39           DiPietro, Mark J.         Reg. No. 28,707         Schuman, Mark D.         Reg. No. 31           Edell, Robert T.         Reg. No. 20,187         Schumann, Michael D.         Reg. No. 30           Epp Ryan, Sandra         Reg. No. 39,667         Scull, Timothy B.         Reg. No. 42           Glance, Robert J.         Reg. No. 40,620         Sebald, Gregory A.         Reg. No. 33           Goggin, Matthew J.         Reg. No. 26,896         Spellman, Steven J.         Reg. No. 45	512 148 703 767 707
Coldren, Richard J         Reg. No. 44.084         Qualcy, Terry         Reg. No. 25           Daignault, Ronald A.         Reg. No. 25,968         Reich, John C.         Reg. No. 37           Daley, Dennis R.         Rcg. No. 34,994         Rciland, Earl D.         Reg. No. 25           Dalglish, Leslie B.         Reg. No. 40,579         Roberts, Fred         Reg. No. 34           Daulton, Julie R.         Reg. No. 36,414         Samuels, Lisa A.         Reg. No. 43           DeVries Smith, Katherine M.         Reg. No. 42,157         Schmaltz, David G.         Reg. No. 39           DiPietro, Mark J.         Reg. No. 28,707         Schuman, Mark D.         Reg. No. 31           Edell, Robert T.         Reg. No. 20,187         Schumann, Michael D.         Reg. No. 30           Epp Ryan, Sandra         Reg. No. 39,667         Scull, Timothy B.         Reg. No. 42           Glance, Robert J.         Reg. No. 40,620         Sebald, Gregory A.         Reg. No. 33           Goggin, Matthew J.         Reg. No. 44,125         Skoog, Mark T.         Reg. No. 45           Golla, Charles E.         Reg. No. 26,896         Spellman, Steven J.         Reg. No. 45	148 703 767 707
Daignault, Ronald A.  Reg. No. 25,968  Reich, John C.  Reg. No. 37  Daley, Dennis R.  Reg. No. 34,994  Reiland, Earl D.  Reg. No. 25  Reg. No. 25  Reg. No. 36,414  Daulton, Julie R.  Reg. No. 36,414  Devrices Smith, Katherine M.  Reg. No. 42,157  DiPietro, Mark J.  Reg. No. 28,707  Reg. No. 20,187  Reg. No. 30,867  Reg. No. 39,667  Glance, Robert J.  Reg. No. 40,620  Reg. No. 42,125  Reg. No. 42,125  Reg. No. 40,620  Reg. No. 42,125  Reg. No. 42,125  Reg. No. 40,620  Reg. No. 40,620  Reg. No. 44,125  Reg. No. 45,896  Reg. No. 26,896  Reg. No. 26,896  Reich, John C.  Reg. No. 37  Reg. No. 25  Reg. No. 25  Reg. No. 34  Reg. No. 34  Reg. No. 34  Reg. No. 39,667  Schuman, Michael D.  Reg. No. 40,620  Sebald, Gregory A.  Reg. No. 33  Reg. No. 44,125  Reg. No. 44,125  Skoog, Mark T.  Reg. No. 45  Reg. No. 45	703 767 707
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Edell, Robert T.         Reg. No. 20,187         Schumann, Michael D.         Reg. No. 30, 30, 667           Epp Ryan, Sandra         Reg. No. 39,667         Scull, Timothy B.         Reg. No. 42, 620           Glance, Robert J.         Reg. No. 40,620         Sebald, Gregory A.         Reg. No. 33, 60, 3	828
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Glance, Robert J. Reg. No. 40,620 Sebald, Gregory A. Reg. No. 33. Goggin, Matthew J. Reg. No. 44,125 Skoog, Mark T. Reg. No. 40. Golla, Charles E. Reg. No. 26,896 Spellman, Steven J. Reg. No. 45.	422
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Golla, Charles E. Reg. No. 26,896 Spellman, Steven J. Reg. No. 45	
Gorman, Alan G. Reg. No. 38,472 Stoll- DeBell, Kirstin L. Reg. No. 43.	
Gould, John D. Reg. No. 18,223 Sumner, John P. Reg. No. 29,	
Gregson, Richard Reg. No. 41,804 Swenson, Erik G. Reg. No. 45	
Gresens, John J. Reg. No. 33,112 Tellekson, David K. Reg. No. 32.	
Hamer, Samuel A. Reg. No. 46,754 Trembath, Jon R. Reg. No. 38,	
Hamre, Curtis B. Reg. No. 29,165 Tuchman, Ido Reg. No. 45,	
Harrison, Kevin C. Reg. No. 46,759 Tunheim, Marcia A Reg. No. 42,	
Hertzberg, Brett A. Reg. No. 42,660 Underhill, Albert L. Reg. No. 27,	
Hillson, Randall A. Reg. No. 31,838 Vandenburgh, J. Derek Reg. No. 32,	
Holzer, Jr., Richard J. Reg. No. 42,668 Wahl, John R. Reg. No. 33,	
Johnston, Scott W. Reg. No. 39,721 Weaver, Karrie G. Reg. No. 43.	
Kadievitch, Natalie D. Reg. No. 34,196 Welter, Paul A. Reg. No. 20,	
Karjeker, Shaukat Reg. No. 34,049 Whipps, Brian Reg. No. 43,	229 161
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Leon, Andrew J. Reg. No. 46,869 Zculi, Anthony R. Reg. No. 45,	376 980 361 536

I hereby authorize them to act and rely on instructions from and communicate directly with the person/assignec/attorney/firm/ organization who/which first sends/sent this case to them and by whom/which I hereby declare that I have consented after full disclosure to be represented unless/until I instruct Merchant & Gould P.C. to the contrary.

Please direct all correspondence in this case to Mcrchant & Gould P.C. at the address indicated below:

6:29 141597032 .

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ı	Full Name	Family Name	First Given Name		Second Given Name
	Of Inventor	MACNALLY	Donald		Evan
	1-00			•	
ļ	Residence	City	State or Foreign Country		Country of Citizenship
	& Citizenship	San Francisco	-		1 1 1
	Post Office	Post Office Address	California		U.S.A.
			City		State & Zip Code/Country
	Address	141 Peronte Street	San Francisco		California 94110 U.S.A.
ma '	nture of Inventor	201: Corald E. Mor lo		Date:	. / /
۷,		L'Orges C, Troc 10	e e	X //	119 (2001
1	Full Name	Family Name	First Given Name		Second Given Name
	Of Inventor	СНО	Thomas		B.
-			- 110411011		<sup>5</sup> .
	Residence	City	State Paris Conta		5
J	& Citizenship	Alameda	State or Foreign Country		Country of Citizenship
ı	Post Office	Post Office Address	California	······································	U.S.A.
	Address		City		State & Zip Code/Country
1		356 Olcander Avenue	Alameda		California 94502 U.S.A.
98	ture of Inventor	202:		Date:	
	Full Name	Family Name	First Given Name		
7	Of Inventor	RABII			Second Given Name
L		20 3024	Shahriar		
-	Residence	City	State or Foreign Country		Country of Citizenship
1	& Citizenship	Pale Alto	California		U.S.A.
1	Post Office	Post Office Address	City		State & Zip Code/Country
, i	Address	2162 Staunton Court	Palo Alto		
ia ia	ture of Inventor 2		2 111 V 7310	Date:	California 94306 U.S.A.
_				and the second second second second	The second secon
	Full Name	Family Name	First Given Name		Second Given Name
ŀ	Full Name Of Inventor	Family Name MEHTA	First Given Name Srenik		Second Given Name Suresh
ŀ	<del></del>	1	1		Second Given Name Suresh
	<del></del>	МЕНТА	Srenik		Suresh
-	Of Inventor	1	State or Foreign Country		Suresh  Country of Citizenship
	Of Inventor Residence & Citizenship	MEHTA  City Pleasanton	State or Forcign Country California		Suresh  Country of Citizenship  U.S.A.
	Of Inventor  Residence & Citizenship  Post Office	MEHTA  City Pleasanton  Post Office Address	State or Foreign Country California City		Country of Citizenship U.S.A. State & Zip Code/Country
	Of Inventor  Residence & Citizenship  Post Office  Address	MEHTA  City Pleasanton  Post Office Address 3543 Gresham Court	State or Forcign Country California		Suresh  Country of Citizenship  U.S.A.
	Of Inventor  Residence & Citizenship  Post Office	MEHTA  City Pleasanton  Post Office Address 3543 Gresham Court	State or Foreign Country California City	Date:	Country of Citizenship U.S.A. State & Zip Code/Country
ato	Of Inventor  Residence & Citizenship  Post Office  Address	MEHTA  City Pleasanton  Post Office Address 3543 Gresham Court	State or Foreign Country California City Pleasanton	Date:	Country of Citizenship U.S.A. State & Zip Code/Country California 94588 U.S.A.
ato	Of Inventor  Residence & Citizenship  Post Office Address  urc of Inventor 2	MEHTA  City Pleasanton  Post Office Address 3543 Gresham Court	State or Foreign Country California City Pleasanton First Given Name	Date:	Suresh  Country of Citizenship U.S.A.  State & Zip Code/Country California 94588 U.S.A.  Second Given Name
ato	Of Inventor  Residence & Citizenship  Post Office Address  ure of Inventor 2  Full Name	MEHTA  City Pleasanton  Post Office Address 3543 Gresham Court  04:  Family Name	State or Foreign Country California City Pleasanton	Date:	Country of Citizenship U.S.A. State & Zip Code/Country California 94588 U.S.A.
at	Of Inventor  Residence & Citizenship  Post Office Address  ure of Inventor 2  Full Name	MEHTA  City Pleasanton  Post Office Address 3543 Gresham Court  04:  Family Name NILSON	State or Foreign Country California City Pleasanton First Given Name Christopher	Date:	Country of Citizenship U.S.A. State & Zip Code/Country California 94588 U.S.A.  Second Given Name Donald
ato	Of Inventor  Residence & Citizenship  Post Office Address  urc of Inventor 2  Full Name Of Inventor  Residence	MEHTA  City Pleasanton  Post Office Address 3543 Gresham Court  04:  Family Name NILSON  City	State or Foreign Country California City Pleasanton  First Given Name Christopher State or Foreign Country	Date:	Suresh  Country of Citizenship U.S.A.  State & Zip Code/Country California 94588 U.S.A.  Second Given Name Donald  Country of Citizenship
ab	Of Inventor  Residence & Citizenship  Post Office Address  ure of Inventor 2  Full Name Of Inventor  Residence & Citizenship	MEHTA  City Pleasanton  Post Office Address 3543 Gresham Court  04:  Family Name NILSON  City San Jose	State or Foreign Country California City Pleasanton  First Given Name Christopher State or Foreign Country California	Date:	Country of Citizenship U.S.A. State & Zip Code/Country California 94588 U.S.A.  Second Given Name Donald
at	Of Inventor  Residence & Citizenship  Post Office  Address  sure of Inventor 2  Full Name  Of Inventor  Residence & Citizenship  Post Office	City Pleasanton Post Office Address 3543 Gresham Court 04:  Family Name NILSON  City San Jose Post Office Address	State or Foreign Country California City Pleasanton  First Given Name Christopher State or Foreign Country	Date:	Suresh  Country of Citizenship U.S.A.  State & Zip Code/Country California 94588 U.S.A.  Second Given Name Donald  Country of Citizenship
lat	Of Inventor  Residence & Citizenship  Post Office Address  ure of Inventor 2  Full Name Of Inventor  Residence & Citizenship	City Pleasanton  Post Office Address 3543 Gresham Court  04:  Family Name NILSON  City San Jose  Post Office Address 170 South 14th Street	State or Foreign Country California City Pleasanton  First Given Name Christopher State or Foreign Country California	Date:	Suresh  Country of Citizenship U.S.A.  State & Zip Code/Country California 94588 U.S.A.  Second Given Name Donald  Country of Citizenship U.S.A.

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<b>6:</b> 29	141,59703

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Full Name		First Given Name Menno	Second Given Name
			Country of Citizenship
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& Citizens Post Office Address Consture of Inve	hip San Francisco Post Office Address 25 Conrad Street	California	Notherlands
& Citizens Post Office Address Consture of Inve	hip San Francisco Post Office Address 25 Conrad Street enter 208:	California City	Notherlands State & Zip Code/Country California 94131 U.S.A.
& Citizens Post Office Address mature of Inve	hip San Francisco Post Office Address 25 Conrad Street enter 208: Family Name	California City San Francisco	Notherlands  State & Zip Code/Country California 94131 U.S.A.  Date:
& Citizens Post Office Address mature of Invento Full Name Of Invento	hip San Francisco Post Office Address 25 Conrad Street enter 208: Family Name	California City San Francisco First Given Name	Notherlands  State & Zip Code/Country California 94131 U.S.A.  Date:  Second Given Name S.  Country of Citizenship
Post Office Address Posture of Inventor  Full Name Of Inventor  Residence & Citizens	hip San Francisco Post Office Address 25 Conrad Street entor 208; Family Name DUKATZ  City San Francisco	California City San Francisco First Given Name Eric	Notherlands State & Zip Code/Country California 94131 U.S.A.  Date:  Second Given Name S.
& Citizens Post Office Address mature of Invento Full Name Of Invento Residence	hip San Francisco Post Office Address 25 Conrad Street entor 208; Family Name DUKATZ  City San Francisco	California City San Francisco  First Given Name Eric  State or Foreign Country	Notherlands  State & Zip Code/Country California 94131 U.S.A.  Date:  Second Given Name S.  Country of Citizenship

# 6:29 1415970333

## § 1.56 Duty to disclose information material to patentability.

- (a) A patent by its very nature is affected with a public interest. The public interest is best served, and the most effective patent examination occurs when, at the time an application is being examined, the Office is aware of and evaluates the teachings of all information material to patentability. Each individual associated with the filing and prosecution of a patent application has a duty of candor and good faith in dealing with the Office, which includes a duty to disclose to the Office all information known to that individual to be material to patentability as defined in this section. The duty to disclose information exists with respect to each pending claim until the claim is canceled or withdrawn from consideration, or the application becomes abandoned. Information material to the patentability of a claim that is canceled or withdrawn from consideration need not be submitted if the information is not material to the patentability of any claim remaining under consideration in the application. There is no duty to submit information which is not material to the patentability of any existing claim. The duty to disclose all information known to be material to patentability is deemed to be satisfied if all information known to be material to patentability of any claim issued in a patent was cited by the Office or submitted to the Office in the manner prescribed by §§ 1.97(b)-(d) and 1.98. However, no patent will be granted on an application in connection with which fraud on the Office was practiced or attempted or the duty of disclosure was violated through bad faith or intentional misconduct. The Office encourages applicants to carefully examine:
  - (1) prior art cited in search reports of a foreign patent office in a counterpart application, and
- (2) the closest information over which individuals associated with the filing or prosecution of a patent application believe any pending claim patentably defines, to make sure that any material information contained therein is disclosed to the Office.
- (b) Under this section, information is material to patentability when it is not cumulative to information already of record or being made of record in the application, and

  (1) It establishes by itself or in combination with other information, a prime facile case of unpatentability of a
- (1) It establishes, by itself or in combination with other information, a prima facie case of unpatentability of a

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- (2) It refutes, or is inconsistent with, a position the applicant takes in:
  - (i) Opposing an argument of unpatentability relied on by the Office, or
  - (ii) Asserting an argument of patentability.

A prima facie case of unpatentability is established when the information compels a conclusion that a claim is unpatentable under the preponderance of evidence, burden-of-proof standard, giving each term in the claim its broadest reasonable construction consistent with the specification, and before any consideration is given to evidence which may be submitted in an attempt to establish a contrary conclusion of patentability.

- (c) Individuals associated with the filing or prosecution of a patent application within the meaning of this section are:
  - (1) Each inventor named in the application:
  - (2) Each attorney or agent who prepares or prosecutes the application; and
- (3) Every other person who is substantively involved in the preparation or prosecution of the application and who is associated with the inventor, with the assignee or with anyone to whom there is an obligation to assign the application.
- (d) Individuals other than the attorney, agent or inventor may comply with this section by disclosing information to the attorney, agent, or inventor.

### MERCHANT & GOULD P.C.

### **United States Patent Application**

### COMBINED DECLARATION AND POWER OF ATTORNEY

As a below named inventor I hereby declare that: my residence, post office address and citizenship are as stated below next to my name; that

I verily believe I am the original, first and sole inventor (if only one name is listed below) or a joint inventor (if plural inventors are named below) of the subject matter which is claimed and for which a patent is sought on the invention entitled: A SINGLE-CHIP CMOS DIRECT-CONVERSION TRANSCEIVER

The specification of which a. is attached hereto	1			
b.  was filed on Febru PCT-filed application) des	ary 8, 2001 as application serial no. cribed and claimed in international narry), which I have reviewed and for warry.	o. PCT/US99/20792 filed Sep	otember 10, 1999, and as amended	e of a d on
I hereby state that I have a any amendment referred t	reviewed and understand the contents o above.	of the above-identified specifi	cation, including the claims, as an	nended by
I acknowledge the duty to of Federal Regulations, §	disclose information which is material. 1.56 (attached hereto).	al to the patentability of this ap	oplication in accordance with Title	37, Code
inventor's certificate listed	ority benefits under Title 35, United a below and have also identified below lication on the basis of which priority	v any foreign application for p	foreign application(s) for patent or patent or inventor's certificate havi	or ing a filing
a no such application b such applications h	s have been filed. ave been filed as follows:			
37 - 12	FOREIGN APPLICATION(S), IF ANY,	CLAIMING PRIORITY UNDER:	35 USC § 119	
<b>CO</b> UNTRY	APPLICATION NUMBER	DATE OF FILING	DATE OF ISSUE	
<u></u>		(day, month, year)	(day, month, year)	
AL	L FOREIGN APPLICATION(S), IF ANY,	FILED BEFORE THE PRIORITY	APPLICATION(S)	
COUNTRY	APPLICATION NUMBER	DATE OF FILING	DATE OF ISSUE	

I hereby claim the benefit under Title 35, United States Code, § 120/365 of any United States and PCT international application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code, § 112, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, § 1.56(a) which occurred between the filing date of the prior application and the national or PCT international filing date of this application.

U.S. APPLICATION NUMBER	DATE OF FILING (day, month, year)	STATUS (patented, pending, abandoned)

U.S. PROVISIONAL APPLICATION NUMBER	DATE OF FILING (Day, Month, Year)
60/099,723	10 September 1998

I hereby appoint the following attorney(s) and/or patent agent(s) to prosecute this application and to transact all business in the Patent and Trademark Office connected herewith:

	Albrecht, John W.	Reg. No. 40,481	Leonard, Christopher J.	Reg. No. 41,940
	Ali, M. Jeffer	Reg. No. 46,359	Liepa, Mara E.	Reg. No. 40,066
	Anderson, Gregg I.	Reg. No. 28,828	Lindquist, Timothy A.	Reg. No. 40,701
	Batzli, Brian H.	Reg. No. 32,960	Lycke, Lawrence E.	Reg. No. 38,540
	Beard, John L.	Reg. No. 27,612	Mayfield, Denise L.	Reg. No. 33,732
	Berns, John M.	Reg. No. 43,496	McDonald, Daniel W.	Reg. No. 32,044
	Black, Bruce E.	Reg. No. 41,622	McIntyre, Jr., William F.	Reg. No. 44,921
	Branch, John W.	Reg. No. 41,633	Mitchem, M. Todd	Reg. No. 40,731
	Bremer, Dennis C.	Reg. No. 40,528	Mueller, Douglas P.	Reg. No. 30,300
	Bruess, Steven C.	Reg. No. 34,130	Nichols, A. Shane	Reg. No. 43,836
	Byrne, Linda M.	Reg. No. 32,404	Parsons, Nancy J.	Reg. No. 40,364
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	Chiapetta, James R.	Reg. No. 39,634	Prendergast, Paul	Reg. No. 46,068
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100. IPA 11.00 11.00	Dalglish, Leslie E.	Reg. No. 40,579	Roberts, Fred	Reg. No. 34,707
ijĪ	Daulton, Julie R.	Reg. No. 36,414	Samuels, Lisa A.	Reg. No. 43,080
4	DeVries Smith, Katherine M.	Reg. No. 42,157	Schmaltz, David G.	Reg. No. 39,828
first the of the first of the	DiPietro, Mark J.	Reg. No. 28,707	Schuman, Mark D.	Reg. No. 31,197
ATT I	Edell, Robert T.	Reg. No. 20,187	Schumann, Michael D.	Reg. No. 30,422
) '=	Epp Ryan, Sandra	Reg. No. 39,667	Scull, Timothy B.	Reg. No. 42,137
7.4	Glance, Robert J.	Reg. No. 40,620	Sebald, Gregory A.	Reg. No. 33,280
Ŋ	Goggin, Matthew J.	Reg. No. 44,125	Skoog, Mark T.	Reg. No. 40,178
	Golla, Charles E.	Reg. No. 26,896	Spellman, Steven J.	Reg. No. 45,124
ş <del>ill</del>	Gorman, Alan G.	Reg. No. 38,472	Stoll- DeBell, Kirstin L.	Reg. No. 43,164
	Gould, John D.	Reg. No. 18,223	Sumner, John P.	Reg. No. 29,114
# = -	Gregson, Richard	Reg. No. 41,804	Swenson, Erik G.	Reg. No. 45,147
45.2	Gresens, John J.	Reg. No. 33,112	Tellekson, David K.	Reg. No. 32,314
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CJ	Hamre, Curtis B.	Reg. No. 29,165	Tuchman, Ido	Reg. No. 45,924
	Harrison, Kevin C.	Reg. No. 46,759	Tunheim, Marcia A	Reg. No. 42,189
<b>L</b> a	Hertzberg, Brett A.	Reg. No. 42,660	Underhill, Albert L.	Reg. No. 27,403
3	Hillson, Randall A.	Reg. No. 31,838	Vandenburgh, J. Derek	Reg. No. 32,179
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	Knearl, Homer L.	Reg. No. 21,197	Williams, Douglas J.	Reg. No. 27,054
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	Lacy, Paul E.	Reg. No. 38,946	Wu, Tong	Reg. No. 43,361
	Larson, James A.	Reg. No. 40,443	Xu, Min S.	Reg. No. 39,536
	Leon, Andrew J.	Reg. No. 46,869	Zeuli, Anthony R.	Reg. No. 45,255
	,	-6	wan, a multing it.	106.110.43,233

I hereby authorize them to act and rely on instructions from and communicate directly with the person/assignee/attorney/firm/ organization who/which first sends/sent this case to them and by whom/which I hereby declare that I have consented after full disclosure to be represented unless/until I instruct Merchant & Gould P.C. to the contrary.

Please direct all correspondence in this case to Merchant & Gould P.C. at the address indicated below:

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	Full Name	Family Name	First Given Name	Second Given Name
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	& Citizenship	San Francisco	California	U.S.A.
,	Post Office	Post Office Address	City	State & Zip Code/Country
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Tura .	Full Name	Family Name	First Given Name	Second Given Name
ofin Hud	Of Inventor	MARRINGA	Menno	
thin cut th	Residence	City	State or Foreign Country	Country of Citizenship
ĮĮ.	& Citizenship	San Francisco	California	Netherlands
all lines	Post Office	Post Office Address	City	State & Zip Code/Country
	Address	25 Conrad Street	San Francisco	California 94131 U.S.A.
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4	Full Name	Family Name	First Given Name	Second Given Name
	Of Inventor	DUKATZ	Eric	S.
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andre 1	& Citizenship	San Francisco	California	U.S.A.
		Post Office Address	City	State & Zip Code/Country
	Post Office	Fost Office Address	City	State & Lip Code/Country

### § 1.56 Duty to disclose information material to patentability.

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- A patent by its very nature is affected with a public interest. The public interest is best served, and the most effective patent examination occurs when, at the time an application is being examined, the Office is aware of and evaluates the teachings of all information material to patentability. Each individual associated with the filing and prosecution of a patent application has a duty of candor and good faith in dealing with the Office, which includes a duty to disclose to the Office all information known to that individual to be material to patentability as defined in this section. The duty to disclose information exists with respect to each pending claim until the claim is canceled or withdrawn from consideration, or the application becomes abandoned. Information material to the patentability of a claim that is canceled or withdrawn from consideration need not be submitted if the information is not material to the patentability of any claim remaining under consideration in the application. There is no duty to submit information which is not material to the patentability of any existing claim. The duty to disclose all information known to be material to patentability is deemed to be satisfied if all information known to be material to patentability of any claim issued in a patent was cited by the Office or submitted to the Office in the manner prescribed by §§ 1.97(b)-(d) and 1.98. However, no patent will be granted on an application in connection with which fraud on the Office was practiced or attempted or the duty of disclosure was violated through bad faith or intentional misconduct. The Office encourages applicants to carefully examine:
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- (2)the closest information over which individuals associated with the filing or prosecution of a patent application believe any pending claim patentably defines, to make sure that any material information contained therein is disclosed to the Office.
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  - (1) It establishes, by itself or in combination with other information, a prima facie case of unpatentability of a
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- (c) Individuals associated with the filing or prosecution of a patent application within the meaning of this section are:
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  - (2)Each attorney or agent who prepares or prosecutes the application; and
- Every other person who is substantively involved in the preparation or prosecution of the application and who is associated with the inventor, with the assignee or with anyone to whom there is an obligation to assign the application.
- (d) Individuals other than the attorney, agent or inventor may comply with this section by disclosing information to the attorney, agent, or inventor.



### MERCHANT & GOULD P.C.

### **United States Patent Application**

# COMBINED DECLARATION AND POWER OF ATTORNEY

As a below named inventor I hereby declare that: my residence, post office address and citizenship are as stated below next to my name; that

I verily believe I am the original, first and sole inventor (if only one name is listed below) or a joint inventor (if plural inventors are named below) of the subject matter which is claimed and for which a patent is sought on the invention entitled: A SINGLE-CHIP CMOS DIRECT-CONVERSION TRANSCEIVER

The specification of which			
a. is attached hereto			
b. 🔯 was filed on February 8, 20	001 as application serial no. 09	/762,720 and was amended on	(if applicable) (in the case of a
PCT-filed application) described at	nd claimed in international no.	PCT/US99/20792 filed September	10, 1999, and as amended on
September 27, 2000 (if any), which	ch I have reviewed and for which	ch I solicit a United States patent.	
<del>-</del>			
I hereby state that I have reviewed	and understand the contents of	the above-identified specification,	including the claims, as amended by
any amendment referred to above.			
- 6년 1월대			
		to the patentability of this application	on in accordance with Title 37, Code
of Federal Regulations, § 1.56 (att	ached hereto).		
I hereby claim foreign priority ben			
			r inventor's certificate having a filing
date before that of the application of	on the basis of which priority is	s claimed:	
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a. no such applications have b			
b such applications have been	i filed as follows:		
<u> </u>			
FORE	IGN APPLICATION(S), IF ANY, C	LAIMING PRIORITY UNDER 35 USC	119
COUNTRY	APPLICATION NUMBER	DATE OF FILING	DATE OF ISSUE
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ALL FOREI	GN APPLICATION(S), IF ANY, FI	LED BEFORE THE PRIORITY APPLIC	CATION(S)
COUNTRY	APPLICATION NUMBER	DATE OF FILING	DATE OF ISSUE
		(day, month, year)	(day, month, year)
		1	

I hereby claim the benefit under Title 35, United States Code, § 120/365 of any United States and PCT international application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code, § 112, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, § 1.56(a) which occurred between the filing date of the prior application and the national or PCT international filing date of this application.

U.S. APPLICATION NUMBER	DATE OF FILING (day, month, year)	STATUS (patented, pending, abandoned)

U.S. PROVISIONAL APPLICATION NUMBER	DATE OF FILING (Day, Month, Year)	
60/099,723	10 September 1998	

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I hereby appoint the following attorney(s) and/or patent agent(s) to prosecute this application and to transact all business in the Patent and Trademark Office connected herewith:

	Albrecht, John W.	Reg. No. 40,481	Leonard, Christopher J.	Reg. No. 41,940
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	Anderson, Gregg I.	Reg. No. 28,828	Lindquist, Timothy A.	Reg. No. 40,701
	Batzli, Brian H.	Reg. No. 32,960	Lycke, Lawrence E.	Reg. No. 38,540
	Beard, John L.	Reg. No. 27,612	Mayfield, Denise L.	Reg. No. 33,732
	Berns, John M.	Reg. No. 43,496	McDonald, Daniel W.	Reg. No. 32,044
	Black, Bruce E.	Reg. No. 41,622	McIntyre, Jr., William F.	Reg. No. 44,921
	Branch, John W.	Reg. No. 41,633	Mitchem, M. Todd	Reg. No. 40,731
	Bremer, Dennis C.	Reg. No. 40,528	Mueller, Douglas P.	Reg. No. 30,300
	Bruess, Steven C.	Reg. No. 34,130	Nichols, A. Shane	Reg. No. 43,836
	Byrne, Linda M.	Reg. No. 32,404	Parsons, Nancy J.	Reg. No. 40,364
	Campbell, Keith	Reg. No. 46,597	Pauly, Daniel M.	Reg. No. 40,123
	Carlson, Alan G.	Reg. No. 25,959	Phillips, Bryan K.	Reg. No. 46,990
	Caspers, Philip P.	Reg. No. 33,227	Phillips, John B.	Reg. No. 37,206
	Chiapetta, James R.	Reg. No. 39,634	Prendergast, Paul	Reg. No. 46,068
	Clifford, John A.	Reg. No. 30,247	Pytel, Melissa J.	Reg. No. 41,512
	Coldren, Richard J	Reg. No 44,084	Qualey, Terry	Reg. No. 25,148
	Daignault, Ronald A.	Reg. No. 25,968	Reich, John C.	Reg. No. 37,703
	Daley, Dennis R.	Reg. No. 34,994	Reiland, Earl D.	Reg. No. 25,767
:	Dalglish, Leslie E.	Reg. No. 40,579	Roberts, Fred	Reg. No. 34,707
	Daulton, Julie R.	Reg. No. 36,414	Samuels, Lisa A.	Reg. No. 43,080
	DeVries Smith, Katherine M.	Reg. No. 42,157	Schmaltz, David G.	Reg. No. 39,828
	DiPietro, Mark J.	Reg. No. 28,707	Schuman, Mark D.	Reg. No. 31,197
Ì	Edell, Robert T.	Reg. No. 20,187	Schumann, Michael D.	Reg. No. 30,422
	Epp Ryan, Sandra	Reg. No. 39,667	Scull, Timothy B.	Reg. No. 42,137
	Glance, Robert J.	Reg. No. 40,620	Sebald, Gregory A.	Reg. No. 33,280
	Goggin, Matthew J.	Reg. No. 44,125	Skoog, Mark T.	Reg. No. 40,178
	Golla, Charles E.	Reg. No. 26,896	Spellman, Steven J.	Reg. No. 45,124
7	Gorman, Alan G.	Reg. No. 38,472	Styll- DeBell, Kirstin L.	Reg. No. 43,124
	Gould, John D.	Reg. No. 18,223	Sumner, John P.	Reg. No. 29,114
=	Gregson, Richard	Reg. No. 41,804	Swenson, Erik G.	Reg. No. 45,147
;	Gresens, John J.	Reg. No. 33,112	Tellekson, David K.	Reg. No. 32,314
•	Hamer, Samuel A.	Reg. No. 46,754	Trembath, Jon R.	Reg. No. 38,344
	Hamre, Curtis B.	Reg. No. 29,165	Tuchman, Ido	Reg. No. 45,924
	Harrison, Kevin C.	Reg. No. 46,759	Tunheim, Marcia A	Reg. No. 42,189
	Hertzberg, Brett A.	Reg. No. 42,660	Underhill, Albert L.	Reg. No. 27,403
3	Hillson, Randall A.	Reg. No. 31,838	Vandenburgh, J. Derek	Reg. No. 32,179
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### § 1.56 Duty to disclose information material to patentability.

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F.

claim; or

- (a) A patent by its very nature is affected with a public interest. The public interest is best served, and the most effective patent examination occurs when, at the time an application is being examined, the Office is aware of and evaluates the teachings of all information material to patentability. Each individual associated with the filing and prosecution of a patent application has a duty of candor and good faith in dealing with the Office, which includes a duty to disclose to the Office all information known to that individual to be material to patentability as defined in this section. The duty to disclose information exists with respect to each pending claim until the claim is canceled or withdrawn from consideration, or the application becomes abandoned. Information material to the patentability of a claim that is canceled or withdrawn from consideration need not be submitted if the information is not material to the patentability of any claim remaining under consideration in the application. There is no duty to submit information which is not material to the patentability of any existing claim. The duty to disclose all information known to be material to patentability is deemed to be satisfied if all information known to be material to patentability of any claim issued in a patent was cited by the Office or submitted to the Office in the manner prescribed by §§ 1.97(b)-(d) and 1.98. However, no patent will be granted on an application in connection with which fraud on the Office was practiced or attempted or the duty of disclosure was violated through bad faith or intentional misconduct. The Office encourages applicants to carefully examine:
  - (1) prior art cited in search reports of a foreign patent office in a counterpart application, and
- (2) the closest information over which individuals associated with the filing or prosecution of a patent application believe any pending claim patentably defines, to make sure that any material information contained therein is disclosed to the Office.
- (b) Under this section, information is material to patentability when it is not cumulative to information already of record or being made of record in the application, and
  - (1) It establishes, by itself or in combination with other information, a prima facie case of unpatentability of a
    - (2) It refutes, or is inconsistent with, a position the applicant takes in:
      - (i) Opposing an argument of unpatentability relied on by the Office, or
      - (ii) Asserting an argument of patentability.

A prima facie case of unpatentability is established when the information compels a conclusion that a claim is unpatentable under the preponderance of evidence, burden-of-proof standard, giving each term in the claim its broadest reasonable construction consistent with the specification, and before any consideration is given to evidence which may be submitted in an attempt to establish a contrary conclusion of patentability.

- (c) Individuals associated with the filing or prosecution of a patent application within the meaning of this section are:
  - (1) Each inventor named in the application:
  - (2) Each attorney or agent who prepares or prosecutes the application; and
- (3) Every other person who is substantively involved in the preparation or prosecution of the application and who is associated with the inventor, with the assignee or with anyone to whom there is an obligation to assign the application.
- (d) Individuals other than the attorney, agent or inventor may comply with this section by disclosing information to the attorney, agent, or inventor.

# #5

### MERCHANT & GOULD P.C.

### **United States Patent Application**

### COMBINED DECLARATION AND POWER OF ATTORNEY

As a below named inventor I hereby declare that: my residence, post office address and citizenship are as stated below next to my name; that

I verily believe I am the original, first and sole inventor (if only one name is listed below) or a joint inventor (if plural inventors are named below) of the subject matter which is claimed and for which a patent is sought on the invention entitled: A SINGLE-CHIP CMOS DIRECT-CONVERSION TRANSCEIVER

The specification of which	h			
a. is attached hereto				
<ul> <li>b.  was filed on Febru</li> </ul>	ary 8, 2001 as application serial no. (	09/762,720 and was amende	ed on (if applicable) (in the case of	of a
	scribed and claimed in international no			n
September 27, 2000 (if a	ny), which I have reviewed and for when	hich I solicit a United States	patent.	
I hereby state that I have:	reviewed and understand the contents	of the above-identified specif	fication, including the claims, as ame	nded by
any amendment referred t	to above.			
I acknowledge the duty to	disclose information which is materia	I to the patentability of this a	application in accordance with Title 3	7. Code
of Federal Regulations, §		- · · · · · · · · · · · · · · · · · · ·	TT	,, 0000
I hereby claim foreign pri	ority benefits under Title 35, United S	States Code, § 119/365 of an	y foreign application(s) for patent or	
	d below and have also identified below			a filing
	olication on the basis of which priority		•	, ,
100 TO		*		
a <sub>∗</sub> no such application	as have been filed.	×.		
b such applications h	ave been filed as follows:			
in in				
180 E	FOREIGN APPLICATION(S), IF ANY,	CLAIMING PRIORITY UNDER	35 USC § 119	
COUNTRY	APPLICATION NUMBER	DATE OF FILING	DATE OF ISSUE	
ide me.		(day, month, year)	(day, month, year)	
Spirit and				
AI	LL FOREIGN APPLICATION(S), IF ANY, I	FILED BEFORE THE PRIORITY	Y APPLICATION(S)	
COUNTRY	APPLICATION NUMBER	DATE OF FILING	DATE OF ISSUE	
		(day, month, year)	(day, month, year)	

I hereby claim the benefit under Title 35, United States Code, § 120/365 of any United States and PCT international application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code, § 112, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, § 1.56(a) which occurred between the filing date of the prior application and the national or PCT international filing date of this application.

U.S. APPLICATION NUMBER	DATE OF FILING (day, month, year)	STATUS (patented, pending, abandoned)

U.S. PROVISIONAL APPLICATION NUMBER	DATE OF FILING (Day, Month, Year)
60/099,723	10 September 1998

I hereby appoint the following attorney(s) and/or patent agent(s) to prosecute this application and to transact all business in the Patent and Trademark Office connected herewith:

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Beard, John L.	Reg. No. 27,612	Mayfield, Denise L.	Reg. No. 33,732
Berns, John M.	Reg. No. 43,496	McDonald, Daniel W.	Reg. No. 32,044
Black, Bruce E.	Reg. No. 41,622	McIntyre, Jr., William F.	Reg. No. 44,921
Branch, John W.	Reg. No. 41,633	Mitchem, M. Todd	Reg. No. 40,731
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Daley, Dennis R.	Reg. No. 34,994	Reiland, Earl D.	Reg. No. 25,767
• ·	Reg. No. 40,579	Roberts, Fred	Reg. No. 34,707
Dalglish, Leslie E.		· · · · · · · · · · · · · · · · · · ·	
Daulton, Julie R.	Reg. No. 36,414	Samuels, Lisa A.	Reg. No. 43,080
DeVries Smith, Katherine M.	Reg. No. 42,157	Schmaltz, David G.	Reg. No. 39,828
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Gresens, John J.	Reg. No. 33,112	Tellekson, David K.	Reg. No. 32,314
Hamer, Samuel A.	Reg. No. 46,754	Trembath, Jon R.	Reg. No. 38,344
Hamre, Curtis B.	Reg. No. 29,165	Tuchman, Ido	Reg. No. 45,924
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Hillson, Randall A.	Reg. No. 31,838	Vandenburgh, J. Derek	Reg. No. 32,179
Holzer, Jr., Richard J.	Reg. No. 42,668	Wahl, John R.	Reg. No. 33,044
Johnston, Scott W.	Reg. No. 39,721	Weaver, Karrie G.	Reg. No. 43,245
Kadievitch, Natalie D.	Reg. No. 34,196	Welter, Paul A.	Reg. No. 20,890
Karjeker, Shaukat	Reg. No. 34,049	Whipps, Brian	Reg. No. 43,261
Kettelberger, Denise	Reg. No. 33,924	Whitaker, John E.	Reg. No. 42,222
Keys, Jeramie J.	Reg. No. 42,724	Wickhem, J. Scot	Reg. No. 41,376
Knearl, Homer L.	Reg. No. 21,197	Williams, Douglas J.	Reg. No. 27,054
Kowalchyk, Alan W.	Reg. No. 31,535	Withers, James D.	Reg. No. 40,376
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Lacy, Paul E.	Reg. No. 38,946	Wu, Tong	Reg. No. 43,361
Larson, James A.	Reg. No. 40,443	Xu, Min S.	Reg. No. 39,536
Leon, Andrew J.	Reg. No. 46,869	Zeuli, Anthony R.	Reg. No. 45,255

I hereby authorize them to act and rely on instructions from and communicate directly with the person/assignee/attorney/firm/ organization who/which first sends/sent this case to them and by whom/which I hereby declare that I have consented after full disclosure to be represented unless/until I instruct Merchant & Gould P.C. to the contrary.

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di .	F888.4. 311111		£,	<u> </u>	
<b> -</b> -	Full Name	Family Name	First Given Name		Second Given Name
<b>2</b> .i	Of Inventor	DUKATZ	Eric		S.
05	Residence	City	State or Foreign Country		Country of Citizenship
C)	& Citizenship	San Francisco	California		U.S.A.
9.i	Post Office	Post Office Address	City		State & Zip Code/Country
	Address	Apartment 2, 1012 Kirkham Street	San Francisco	1	California 94122 U.S.A.
Signa	ature of Inventor 2	209:		Date:	

### § 1.56 Duty to disclose information material to patentability.

claim;

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SH.

- (a) A patent by its very nature is affected with a public interest. The public interest is best served, and the most effective patent examination occurs when, at the time an application is being examined, the Office is aware of and evaluates the teachings of all information material to patentability. Each individual associated with the filing and prosecution of a patent application has a duty of candor and good faith in dealing with the Office, which includes a duty to disclose to the Office all information known to that individual to be material to patentability as defined in this section. The duty to disclose information exists with respect to each pending claim until the claim is canceled or withdrawn from consideration, or the application becomes abandoned. Information material to the patentability of a claim that is canceled or withdrawn from consideration need not be submitted if the information is not material to the patentability of any claim remaining under consideration in the application. There is no duty to submit information which is not material to the patentability of any existing claim. The duty to disclose all information known to be material to patentability is deemed to be satisfied if all information known to be material to patentability of any claim issued in a patent was cited by the Office or submitted to the Office in the manner prescribed by §§ 1.97(b)-(d) and 1.98. However, no patent will be granted on an application in connection with which fraud on the Office was practiced or attempted or the duty of disclosure was violated through bad faith or intentional misconduct. The Office encourages applicants to carefully examine:
  - (1) prior art cited in search reports of a foreign patent office in a counterpart application, and
- (2) the closest information over which individuals associated with the filing or prosecution of a patent application believe any pending claim patentably defines, to make sure that any material information contained therein is disclosed to the Office.
- (b) Under this section, information is material to patentability when it is not cumulative to information already of record or being made of record in the application, and
  - (1) It establishes, by itself or in combination with other information, a prima facie case of unpatentability of a
  - (2) It refutes, or is inconsistent with, a position the applicant takes in:
    - (i) Opposing an argument of unpatentability relied on by the Office, or
    - (ii) Asserting an argument of patentability.

Aprima facie case of unpatentability is established when the information compels a conclusion that a claim is unpatentable under the preponderance of evidence, burden-of-proof standard, giving each term in the claim its broadest reasonable construction consistent with the specification, and before any consideration is given to evidence which may be submitted in an attempt to establish a contrary conclusion of patentability.

- (c) Individuals associated with the filing or prosecution of a patent application within the meaning of this section are:
  - (1) Each inventor named in the application:
  - (2) Each attorney or agent who prepares or prosecutes the application; and
- Every other person who is substantively involved in the preparation or prosecution of the application and who is associated with the inventor, with the assignee or with anyone to whom there is an obligation to assign the application.
- (d) Individuals other than the attorney, agent or inventor may comply with this section by disclosing information to the attorney, agent, or inventor.

### MERCHANT & GOULD P.C.

### **United States Patent Application**

### COMBINED DECLARATION AND POWER OF ATTORNEY

As a below named inventor I hereby declare that: my residence, post office address and citizenship are as stated below next to my name; that

I verily believe I am the original, first and sole inventor (if only one name is listed below) or a joint inventor (if plural inventors are named below) of the subject matter which is claimed and for which a patent is sought on the invention entitled: A SINGLE-CHIP CMOS DIRECT-CONVERSION TRANSCEIVER

The specification of which a. is attached hereto b. was filed on February 8, 20 PCT-filed application) described a September 27, 2000 (if any), which	nd claimed in international no. l	PCT/US99/20792 filed September	(if applicable) (in the case of a 10, 1999, and as amended on
any amendment referred to above.  I acknowledge the duty to disclose of Federal Regulations, § 1.56 (att	information which is material trached hereto).  nefits under Title 35, United State and have also identified below a on the basis of which priority is seen filed.	o the patentability of this application tes Code, § 119/365 of any foreign application for patent or	including the claims, as amended by on in accordance with Title 37, Code application(s) for patent or r inventor's certificate having a filing
The state of the s			
FORE	IGN APPLICATION(S), IF ANY, CI	LAIMING PRIORITY UNDER 35 USC	§ 119
COUNTRY	APPLICATION NUMBER	DATE OF FILING (day, month, year)	DATE OF ISSUE (day, month, year)
ALL FORE	GN APPLICATION(S), IF ANY, FII	LED BEFORE THE PRIORITY APPLIC	CATION(S)
COUNTRY	APPLICATION NUMBER	DATE OF FILING (day, month, year)	DATE OF ISSUE (day, month, year)
IL	·	I	t

I hereby claim the benefit under Title 35, United States Code, § 120/365 of any United States and PCT international application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code, § 112, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, § 1.56(a) which occurred between the filing date of the prior application and the national or PCT international filing date of this application.

U.S. APPLICATION NUMBER	DATE OF FILING (day, month, year)	STATUS (patented, pending, abandoned)

U.S. PROVISIONAL APPLICATION NUMBER	DATE OF FILING (Day, Month, Year)
60/099,723	10 September 1998

I hereby appoint the following attorney(s) and/or patent agent(s) to prosecute this application and to transact all business in the Patent and Trademark Office connected herewith:

mark Office connected herewith.			
Albrecht, John W.	Reg. No. 40,481	Leonard, Christopher J.	Reg. No. 41,940
Ali, M. Jeffer	Reg. No. 46,359	Liepa, Mara E.	Reg. No. 40,066
Anderson, Gregg I.	Reg. No. 28,828	Lindquist, Timothy A.	Reg. No. 40,701
Batzli, Brian H.	Reg. No. 32,960	Lycke, Lawrence E.	Reg. No. 38,540
Beard, John L.	Reg. No. 27,612	Mayfield, Denise L.	Reg. No. 33,732
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Gregson, Richard	Reg. No. 41,804	Swenson, Erik G.	Reg. No. 45,147
Gresens, John J.	Reg. No. 33,112	Tellekson, David K.	Reg. No. 32,314
Hamer, Samuel A.	Reg. No. 46,754	Trembath, Jon R.	Reg. No. 38,344
	Reg. No. 29,165	Tuchman, Ido	Reg. No. 45,924
Hamre, Curtis B.	Reg. No. 46,759	Tunheim, Marcia A	Reg. No. 42,189
Harrison, Kevin C. Hertzberg, Brett A.	Reg. No. 42,660	Underhill, Albert L.	Reg. No. 27,403
		Vandenburgh, J. Derek	Reg. No. 32,179
Hillson, Randall A.	Reg. No. 31,838	Wahl, John R.	Reg. No. 32,179
Holzer, Jr., Richard J.	Reg. No. 42,668		Reg. No. 43,245
Johnston, Scott W.	Reg. No. 39,721	Weaver, Karrie G. Welter, Paul A.	Reg. No. 20,890
Kadievitch, Natalie D.	Reg. No. 34,196		
Karjeker, Shaukat	Reg. No. 34,049	Whiteker John F	Reg. No. 43,261
Kettelberger, Denise	Reg. No. 33,924	Whitaker, John E.	Reg. No. 42,222
Keys, Jeramie J.	Reg. No. 42,724	Wickhem, J. Scot	Reg. No. 41,376
Knearl, Homer L.	Reg. No. 21,197	Williams, Douglas J.	Reg. No. 27,054
Kowalchyk, Alan W.	Reg. No. 31,535	Witt Jonella	Reg. No. 40,376
Kowalchyk, Katherine M.	Reg. No. 36,848	Witt, Jonelle	Reg. No. 41,980
Lacy, Paul E.	Reg. No. 38,946	Wu, Tong	Reg. No. 43,361
Larson, James A.	Reg. No. 40,443	Xu, Min S.	Reg. No. 39,536
Leon, Andrew J.	Reg. No. 46,869	Zeuli, Anthony R.	Reg. No. 45,255

I hereby authorize them to act and rely on instructions from and communicate directly with the person/assignee/attorney/firm/ organization who/which first sends/sent this case to them and by whom/which I hereby declare that I have consented after full disclosure to be represented unless/until I instruct Merchant & Gould P.C. to the contrary.

Please direct all correspondence in this case to Merchant & Gould P.C. at the address indicated below:

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2年 (計画	ature of Inventor 2	002:		Date:	
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	Full Name	Family Name	First Given Name	Second Given Name	
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0	Residence	City	State or Foreign Country	Country of Citizenship	Î.
	& Citizenship	San Francisco	California	U.S.A.	/
6	Post Office	Post Office Address	City	State & Zip Code/Country	
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Signa	ature of Inventor 2	106: Malul Mul	D	April 11, 2001	
	Full Name	Family Name	First Given Name	Second Given Name	
2	Of Inventor	PLOUVIER	Laurence	Marguerite	
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	& Citizenship	San Francisco	California	U.S.A.	
7	Post Office	Post Office Address	City	State & Zip Code/Country	
	Address	141 Bronte Street	San Francisco	California 94110 U.S.A.	
Signa	ature of Inventor 2	07:	D	Pate:	
W.R Quift	Full Name	Family Name	First Given Name	Second Given Name	·
<b>2</b>	Of Inventor	MARRINGA	Menno		
<b>6</b> 1	Residence	City	State or Foreign Country	Country of Citizenship	
	& Citizenship	San Francisco	California	Netherlands	
8	Post Office	Post Office Address	City	State & Zip Code/Country	***************************************
ħj	Address	25 Conrad Street	San Francisco	California 94131 U.S.A.	
Signa	ature of Inventor 2	08:	D	rate:	
ļ.ā	Full Name	Family Name	First Given Name	Second Given Name	
<b>2</b> ÷	Of Inventor	DUKATZ	Eric	S.	
0.3	Residence	City	State or Foreign Country	Country of Citizenship	
	& Citizenship	San Francisco	California	U.S.A.	
= ــــــــــــــــــــــــــــــــــــ	Post Office	Post Office Address	City	State & Zip Code/Country	
	Address	Apartment 2, 1012 Kirkham Street	San Francisco	California 94122 U.S.A.	
Signa	ture of Inventor 2	09:	D	ate:	
					_

### § 1.56 Duty to disclose information material to patentability.

or [

- (a) A patent by its very nature is affected with a public interest. The public interest is best served, and the most effective patent examination occurs when, at the time an application is being examined, the Office is aware of and evaluates the teachings of all information material to patentability. Each individual associated with the filing and prosecution of a patent application has a duty of candor and good faith in dealing with the Office, which includes a duty to disclose to the Office all information known to that individual to be material to patentability as defined in this section. The duty to disclose information exists with respect to each pending claim until the claim is canceled or withdrawn from consideration, or the application becomes abandoned. Information material to the patentability of a claim that is canceled or withdrawn from consideration need not be submitted if the information is not material to the patentability of any claim remaining under consideration in the application. There is no duty to submit information which is not material to the patentability of any existing claim. The duty to disclose all information known to be material to patentability is deemed to be satisfied if all information known to be material to patentability of any claim issued in a patent was cited by the Office or submitted to the Office in the manner prescribed by §§ 1.97(b)-(d) and 1.98. However, no patent will be granted on an application in connection with which fraud on the Office was practiced or attempted or the duty of disclosure was violated through bad faith or intentional misconduct. The Office encourages applicants to carefully examine:
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  - (1) Each inventor named in the application:
  - (2) Each attorney or agent who prepares or prosecutes the application; and
- (3) Every other person who is substantively involved in the preparation or prosecution of the application and who is associated with the inventor, with the assignee or with anyone to whom there is an obligation to assign the application.
- (d) Individuals other than the attorney, agent or inventor may comply with this section by disclosing information to the attorney, agent, or inventor.

Attorney Docket No.

### MERCHANT & GOULD P.C.

### **United States Patent Application**



CÉMBINED DECLARATION AND POWER OF ATTORNEY

As a below maned investor I hereby declare that: my residence, post office address and citizenship are as stated below next to my name; that

ntors P

are named below) of the subject CMOS DIRECT-CONVERSION	matter which is claimed and fe	or (if only one name is listed or which a patent is sought or	below) or a joint inventor (if plural inventors the invention entitled: A SINGLE-CHIP
September 27, 2000 (if any), w	and claimed in international n hich I have reviewed and for v	to. PCT/US99/20792 filed Sewhich I solicit a United States	eptember 10, 1999, and as amended on patent.
any amendment referred to above I acknowledge the duty to disclor of Federal Regulations, § 1.56 (I hereby claim foreign priority by	e. se information which is materiattached hereto). enefits under Title 35, United v and have also identified belov	al to the patentability of this a States Code, § 119/365 of any w any foreign application for	fication, including the claims, as amended by application in accordance with Title 37, Code y foreign application(s) for patent or patent or inventor's certificate having a filing
a no such applications have be	been filed.	y is claimed.	RECEIVED  → 2001
FOR	EIGN APPLICATION(S), IF ANY,	CLAIMING PRIORITY UNDER	35 USC & 112 OF OF PEN JONS
ÇQUNTRY	APPLICATION NUMBER	DATE OF FILING (day, month, year)	DEWUTOFAASUPATENTS (day, month, year)
ALL FOR	EIGN APPLICATION(S), IF ANY,	FILED BEFORE THE PRIORITY	APPLICATION(S)
COUNTRY	APPLICATION NUMBER	DATE OF FILING (day, month, year)	DATE OF ISSUE (day, month, year)

I hereby claim the benefit under Title 35, United States Code, § 120/365 of any United States and PCT international application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code, § 112, I acknowledge the dail writed as material information as defined in Title 37, Code of Federal Regulations, § 1.56(a) which occurred between the filing date of the prior application and the national or PCT international filing date of this application. NOV 2 9 2001

U.S. APPLICATION NUMBER	DATE OF FILING (day, month, year)	STATUS parement, Rending (Speedoned)
		DEPOTY AVC PATENTS

U.S. PROVISIONAL APPLICATION NUMBER	DATE OF FILING (Day, Month, Year)
60/099,723	10 September 1998

To serve the serve of the serve of the serve than the serve the serve than the serve the serve than the serve the serve t

I hereby appoint the following attorney(s) and/or patent agent(s) to prosecute this application and to transact all business in the Patent and Trademark Office connected herewith:

	Albrecht, John W.	Reg. No. 40,481	Leonard, Christopher J.	Reg. No. 41,940
	Ali, M. Jeffer	Reg. No. 46,359	Liepa, Mara E.	Reg. No. 40,066
	Anderson, Gregg I.	Reg. No. 28,828	Lindquist, Timothy A.	Reg. No. 40,701
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	Beard, John L.	Reg. No. 27,612	Mayfield, Denise L.	
	Berns, John M.		•	Reg. No. 33,732
	·	Reg. No. 43,496	McDonald, Daniel W.	Reg. No. 32,044
	Black, Bruce E.	Reg. No. 41,622	McIntyre, Jr., William F.	Reg. No. 44,921
	Branch, John W.	Reg. No. 41,633	Mitchem, M. Todd	Reg. No. 40,731
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	Byrne, Linda M.	Reg. No. 32,404	Parsons, Nancy J.	Reg. No. 40,364
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	Hamre, Curtis B.	Reg. No. 29,165	Tuchman, Ido	Reg. No. 45,924
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	Kadievitch, Natalie D.	Reg. No. 34,196	Welter, Paul A.	Reg. No. 20,890
	Karjeker, Shaukat	Reg. No. 34,049	Whipps, Brian	Reg. No. 43,261
	Kettelberger, Denise	Reg. No. 33,924	Whitaker, John E.	Reg. No. 42,222
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	Knearl, Homer L.	Reg. No. 21,197	Williams, Douglas J.	Reg. No. 27,054
	Kowalchyk, Alan W.	Reg. No. 31,535	Withers, James D.	Reg. No. 40,376
	Kowalchyk, Katherine M.	Reg. No. 36,848	Witt, Jonelle	Reg. No. 41,980
	Lacy, Paul E.	Reg. No. 38,946	Wu, Tong	Reg. No. 43,361
	Larson, James A.	Reg. No. 40,443	Xu, Min S.	Reg. No. 39,536
	Leon, Andrew J.	Reg. No. 46,869	Zeuli, Anthony R.	Reg. No. 45,255
	· ·	J <del>, -</del>		

I hereby authorize them to act and rely on instructions from and communicate directly with the person/assignee/attorney/firm/ organization who/which first sends/sent this case to them and by whom/which I hereby declare that I have consented after full disclosure to be represented unless/until I instruct Merchant & Gould P.C. to the contrary.

Please direct all correspondence in this case to Merchant & Gould P.C. at the address indicated below:

Merchant & Gould P.C. P.O. Box 2903 Minneapolis, MN 55402-0903 RECEIVED

NOV 2 9 2001

OFFICE OF PETITIONS DEPUTY A/C PATENTS

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· ·	Residence	City	State or Foreign Countr	; <b>y</b>	Country of Citizenship
-2 15	& Citizenship	Alameda	California		U.S.A.
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4 <u>2</u>	Address	356 Oleander Avenue	Alameda		California 94502 U.S.A.
gn:	Residence & Citizenship Post Office Address ature of Inventor 2	202:		Date:	
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4,4	Of Inventor	RABII	Shahriar		
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	Of Inventor	NILSON	Christopher		Donald
	Residence	City	State or Foreign Countr	у	Country of Citizenship
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	& Citizenship	1	۱ ۵.		State & Zip Code/Country
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gna	ature of Inventor 2	06:		Date:
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	Address	141 Bronte Street	San Francisco	California 94110 U.S.A.
gna	ature of Inventor 2	07: Farret		Date: Y October 29th 1001
	Full Name	Family Name	First Given Name	Second Given Name
mel Him	Of Inventor	MARRINGA	Menno	
4	Residence	City	State or Foreign Country	Country of Citizenship
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at History		70 . 0.000 4.33	City	State & Zip Code/Country
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thust time Hiner		Post Office Address  25 Conrad Street	San Francisco	California 94131 U.S.A.
	Post Office	25 Conrad Street	1 "	
gna	Post Office Address	25 Conrad Street	1 "	California 94131 U.S.A.
na	Post Office Address ature of Inventor 2	25 Conrad Street 08:	San Francisco	California 94131 U.S.A.  Date:
gna	Post Office Address ature of Inventor 2	25 Conrad Street 08: Family Name	San Francisco  First Given Name	California 94131 U.S.A.  Date:  Second Given Name
gna	Post Office Address ature of Inventor 2 Full Name Of Inventor	25 Conrad Street 08: Family Name DUKATZ	San Francisco  First Given Name  Eric	California 94131 U.S.A.  Date:  Second Given Name S.
And their their their the three their med then the	Post Office Address ature of Inventor 2 Full Name Of Inventor	25 Conrad Street 08: Family Name DUKATZ City	San Francisco  First Given Name  Eric  State or Foreign Country	California 94131 U.S.A.  Date:  Second Given Name S.  Country of Citizenship

### § 3.56 Duty to disclose information material to patentability.

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- (a) A patent by its very nature is affected with a public interest. The public interest is best served, and the most effective patent examination occurs when, at the time an application is being examined, the Office is aware of and evaluates the teachings of all information material to patentability. Each individual associated with the filing and prosecution of a patent application has a duty of candor and good faith in dealing with the Office, which includes a duty to disclose to the Office all information known to that individual to be material to patentability as defined in this section. The duty to disclose information exists with respect to each pending claim until the claim is canceled or withdrawn from consideration, or the application becomes abandoned. Information material to the patentability of a claim that is canceled or withdrawn from consideration need not be submitted if the information is not material to the patentability of any claim remaining under consideration in the application. There is no duty to submit information which is not material to the patentability of any existing claim. The duty to disclose all information known to be material to patentability is deemed to be satisfied if all information known to be material to patentability of any claim issued in a patent was cited by the Office or submitted to the Office in the manner prescribed by §§ 1.97(b)-(d) and 1.98. However, no patent will be granted on an application in connection with which fraud on the Office was practiced or attempted or the duty of disclosure was violated through bad faith or intentional misconduct. The Office encourages applicants to carefully examine:
  - (1) prior art cited in search reports of a foreign patent office in a counterpart application, and
- the closest information over which individuals associated with the filing or prosecution of a patent application believe any pending claim patentably defines, to make sure that any material information contained therein is disclosed to the Office.
- (b) Under this section, information is material to patentability when it is not cumulative to information already of record or being made of record in the application, and
- (1) It establishes, by itself or in combination with other information, a prima facie case of unpatentability of a claim;
  - (2) It refutes, or is inconsistent with, a position the applicant takes in:
    - (i) Opposing an argument of unpatentability relied on by the Office, or
    - (ii) Asserting an argument of patentability.

A prima facie case of unpatentability is established when the information compels a conclusion that a claim is unpatentable under the preponderance of evidence, burden-of-proof standard, giving each term in the claim its broadest reasonable construction consistent with the specification, and before any consideration is given to evidence which may be submitted in an attempt to establish a contrary conclusion of patentability.

- (c) Individuals associated with the filing or prosecution of a patent application within the meaning of this section are:
  - (1) Each inventor named in the application:
  - (2) Each attorney or agent who prepares or prosecutes the application; and
- (3) Every other person who is substantively involved in the preparation or prosecution of the application and who is associated with the inventor, with the assignee or with anyone to whom there is an obligation to assign the application.
- (d) Individuals other than the attorney, agent or inventor may comply with this section by disclosing information to the attorney, agent, or inventor.

# #5

### MERCHANT & GOULD P.C.

### **United States Patent Application**

# COMBINED DECLARATION AND POWER OF ATTORNEY

As a below named inventor I hereby declare that: my residence, post office address and citizenship are as stated below next to my name; that

I verily believe I am the original, first and sole inventor (if only one name is listed below) or a joint inventor (if plural inventors are named below) of the subject matter which is claimed and for which a patent is sought on the invention entitled: A SINGLE-CHIP CMOS DIRECT-CONVERSION TRANSCEIVER

The specification of which a. $\square$ is attached hereto b. $\boxtimes$ was filed on February 8, 2 PCT-filed application) described a September 27, 2000 (if any), which	and claimed in international no.	9/762,720 and was amended on PCT/US99/20792 filed Septembe ich I solicit a United States patent.	(if applicable) (in the case of a er 10, 1999, and as amended on
any amendment referred to above	•		, including the claims, as amended by
Lacknowledge the duty to disclose	information which is material	to the patentability of this applicati	ion in accordance with Title 37, Code
of Federal Regulations, § 1.56 (at	tached hereto).	or and applicati	on in accordance with Title 37, Code
<u> </u>			
I hereby claim foreign priority ber	nefits under Title 35, United Sta	ates Code, § 119/365 of any foreign	n application(s) for patent or
inventor's certificate fisted below	and have also identified below a	any foreign application for patent of	or inventor's certificate having a filing
date before that of the application	on the basis of which priority is	s claimed:	
		<i>*</i>	
a. o such applications have b			
b such applications have beer	1 filed as follows:		
	IGN APPLICATION(S), IF ANY, C	LAIMING PRIORITY UNDER 35 USC	§ 119
COUNTRY	APPLICATION NUMBER	DATE OF FILING	DATE OF ISSUE
		(day, month, year)	(day, month, year)
4-1			
ALL FOREI	GN APPLICATION(S), IF ANY, FII	LED BEFORE THE PRIORITY APPLIC	CATION(S)
COUNTRY	APPLICATION NUMBER	DATE OF FILING	DATE OF ISSUE
	_	(day, month, year)	(day, month, year)
		,	(uay, month, year)
			(

I hereby claim the benefit under Title 35, United States Code, § 120/365 of any United States and PCT international application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code, § 112, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, § 1.56(a) which occurred between the filing date of the prior application and the national or PCT international filing date of this application.

U.S. APPLICATION NUMBER	DATE OF FILING (day, month, year)	STATUS (patented, pending, abandoned)

U.S. PROVISIONAL APPLICATION NUMBER	DATE OF FILING (Day, Month, Year)
60/099,723	10 September 1998

I hereby appoint the following attorney(s) and/or patent agent(s) to prosecute this application and to transact all business in the Patent and Trademark Office connected herewith:

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	Anderson, Gregg I.	Reg. No. 28,828	Lindquist, Timothy A.	Reg. No. 40,701
	Batzli, Brian H.	Reg. No. 32,960	Lycke, Lawrence E.	Reg. No. 38,540
	Beard, John L.	Reg. No. 27,612	Mayfield, Denise L.	Reg. No. 33,732
	Berns, John M.	Reg. No. 43,496	McDonald, Daniel W.	Reg. No. 32,044
	Black, Bruce E.	Reg. No. 41,622	McIntyre, Jr., William F.	Reg. No. 44,921
	Branch, John W.	Reg. No. 41,633	Mitchem, M. Todd	Reg. No. 40,731
	Bremer, Dennis C.	Reg. No. 40,528	Mueller, Douglas P.	Reg. No. 30,300
	Bruess, Steven C.	Reg. No. 34,130	Nichols, A. Shane	Reg. No. 43,836
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	Carlson, Alan G.	Reg. No. 25,959	Phillips, Bryan K.	Reg. No. 40,123
	Caspers, Philip P.	Reg. No. 33,227	Phillips, John B.	Reg. No. 46,990
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	Clifford, John A.	Reg. No. 30,247	Pytel, Melissa J.	Reg. No. 46,068
	Coldren, Richard J	Reg. No 44,084		Reg. No. 41,512
	Daignault, Ronald A.	Reg. No. 25,968	Qualey, Terry	Reg. No. 25,148
	Daley, Dennis R.	Reg. No. 34,994	Reich, John C.	Reg. No. 37,703
	Dalglish, Leslie E.	Reg. No. 40,579	Reiland, Earl D.	Reg. No. 25,767
4	Daulton, Julie R.	Reg. No. 36,414	Roberts, Fred	Reg. No. 34,707
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4	DiPietro, Mark J.	Reg. No. 28,707	Schmaltz, David G.	Reg. No. 39,828
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	Epp Ryan, Sandra	Reg. No. 20,187	Schumann, Michael D.	Reg. No. 30,422
Amil Amp ellem Ann	Glance, Robert J.	Reg. No. 39,667	Scull, Timothy B.	Reg. No. 42,137
all a		Reg. No. 40,620	Sebald, Gregory A.	Reg. No. 33,280
1	Goggin, Matthew J. Golla, Charles E.	Reg. No. 44,125	Skoog, Mark T.	Reg. No. 40,178
7		Reg. No. 26,896	Spellman, Steven J.	Reg. No. 45,124
=	Gorman, Alan G.	Reg. No. 38,472	Stall- DeBell, Kirstin L.	Reg. No. 43,164
· .	Gould, John D.	Reg. No. 18,223	Sumner, John P.	Reg. No. 29,114
£.	Gregson, Richard	Reg. No. 41,804	Swenson, Erik G.	Reg. No. 45,147
#	Gresens, John J.	Reg. No. 33,112	Tellekson, David K.	Reg. No. 32,314
j	Hamer, Samuel A.	Reg. No. 46,754	Trembath, Jon R.	Reg. No. 38,344
first line firm	Hamre, Curtis B.	Reg. No. 29,165	Tuchman, Ido	Reg. No. 45,924
7	Harrison, Kevin C. Hertzberg, Brett A.	Reg. No. 46,759	Tunheim, Marcia A	Reg. No. 42,189
io L		Reg. No. 42,660	Underhill, Albert L.	Reg. No. 27,403
	Hillson, Randall A.	Reg. No. 31,838	Vandenburgh, J. Derek	Reg. No. 32,179
	Holzer, Jr., Richard J.	Reg. No. 42,668	Wahl, John R.	Reg. No. 33,044
	Johnston, Scott W.	Reg. No. 39,721	Weaver, Karrie G.	Reg. No. 43,245
	Kadievitch, Natalie D.	Reg. No. 34,196	Welter, Paul A.	Reg. No. 20,890
	Karjeker, Shaukat	Reg. No. 34,049	Whipps, Brian	Reg. No. 43,261
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	Keys, Jeramie J.	Reg. No. 42,724	Wickhem, J. Scot	Reg. No. 41,376
	Knearl, Homer L.	Reg. No. 21,197	Williams, Douglas J.	Reg. No. 27,054
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	Kowalchyk, Katherine M.	Reg. No. 36,848	Witt, Jonelle	Reg. No. 41,980
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	Larson, James A.	Reg. No. 40,443	Xu, Min S.	Reg. No. 39,536
	Leon, Andrew J.	Reg. No. 46,869	Zeuli, Anthony R.	Reg. No. 45,255

I hereby authorize them to act and rely on instructions from and communicate directly with the person/assignee/attorney/firm/ organization who/which first sends/sent this case to them and by whom/which I hereby declare that I have consented after full disclosure to be represented unless/until I instruct Merchant & Gould P.C. to the contrary.

Please direct all correspondence in this case to Merchant & Gould P.C. at the address indicated below:

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Hurit Sana Bara Tayan ang	Full Name	Family Name	First Given Name		Second Given Name
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	& Citizenship	Pleasanton	State or Foreign Country California		Country of Citizenship
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gna	ture of Inventor 2		ricasamon	Data	California 94588 U.S.A.
- T				Date:	
	Full Name	Family Name	First Given Name		Second Given Name
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	Full Name	Family Name	First Given Name		Second Given Name
2	Of Inventor	MACK	Michael		Peter
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	& Citizenship	San Francisco	California		U.S.A.
6	Post Office	Post Office Address	City		State & Zip Code/Country
	Address	3114 Clay Street #1	San Francisco	· · · · · · · · · · · · · · · · · · ·	California 94115 U.S.A.
Sign	nature of Inventor 2	206:		Date:	
	Full Name	Family Name	First Given Name		Second Given Name
2	Of Inventor	PLOUVIER	Laurence		Marguerite
)	Residence	City	State or Foreign Country	· · · · · · · · · · · · · · · · · · ·	Country of Citizenship
	& Citizenship	San Francisco	California		U.S.A.
7	Post Office	Post Office Address	City	<del></del>	State & Zip Code/Country
	Address	141 Bronte Street	San Francisco		California 94110 U.S.A.
Sign	ature of Inventor 2	07:		Date:	1
	Full Name	Full Name Family Name First Given Name			
7	Of Inventor	MARRINGA	First Given Name Menno		Second Given Name
J	8-00		Memo		2.4
H	Residence	City	State or Foreign Country		Country of Citizenship
	& Citizenship	San Francisco	i California		Netherlands
m Charle and	& Citizenship Post Office		California		Netherlands
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	Post Office Address ature of Inventor 2	Post Office Address 25 Conrad Street	······································	Date:	
	Post Office	Post Office Address 25 Conrad Street	City	Date:	State & Zip Code/Country
ign	Post Office Address ature of Inventor 2	Post Office Address 25 Conrad Street	City San Francisco		State & Zip Code/Country California 94131 U.S.A.
ign	Post Office Address ature of Inventor 2	Post Office Address 25 Conrad Street 08:	City San Francisco		State & Zip Code/Country California 94131 U.S.A.  APRIL ZVO
:::	Post Office Address ature of Inventor 2 Full Name	Post Office Address 25 Conrad Street 08: Family Name	City San Francisco  First Given Name Eric		State & Zip Code/Country California 94131 U.S.A.  APRIL ZIO Second Given Name S.
ign	Post Office Address ature of Inventor 2 Full Name Of Inventor	Post Office Address 25 Conrad Street 08: Family Name DUKATZ	City San Francisco  First Given Name		State & Zip Code/Country California 94131 U.S.A.  APRIL ZIO Second Given Name S.  Country of Citizenship
	Post Office Address ature of Inventor 2 Full Name Of Inventor Residence	Post Office Address 25 Conrad Street 08:  Family Name DUKATZ City	City San Francisco  First Given Name Eric  State or Foreign Country California		State & Zip Code/Country California 94131 U.S.A.  APRIL Ziro Second Given Name S.  Country of Citizenship U.S.A.
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# § 1.56 Duty to disclose information material to patentability.

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- A patent by its very nature is affected with a public interest. The public interest is best served, and the most effective (a) patent examination occurs when, at the time an application is being examined, the Office is aware of and evaluates the teachings of all information material to patentability. Each individual associated with the filing and prosecution of a patent application has a duty of candor and good faith in dealing with the Office, which includes a duty to disclose to the Office all information known to that individual to be material to patentability as defined in this section. The duty to disclose information exists with respect to each pending claim until the claim is canceled or withdrawn from consideration, or the application becomes abandoned. Information material to the patentability of a claim that is canceled or withdrawn from consideration need not be submitted if the information is not material to the patentability of any claim remaining under consideration in the application. There is no duty to submit information which is not material to the patentability of any existing claim. The duty to disclose all information known to be material to patentability is deemed to be satisfied if all information known to be material to patentability of any claim issued in a patent was cited by the Office or submitted to the Office in the manner prescribed by §§ 1.97(b)-(d) and 1.98. However, no patent will be granted on an application in connection with which fraud on the Office was practiced or attempted or the duty of disclosure was violated through bad faith or intentional misconduct. The Office encourages applicants to carefully examine:
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- (2) the closest information over which individuals associated with the filing or prosecution of a patent application believe any pending claim patentably defines, to make sure that any material information contained therein is disclosed to the Office.
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  (1) It establishes, by it claim; Under this section, information is material to patentability when it is not cumulative to information already of record or (b)
  - It establishes, by itself or in combination with other information, a prima facie case of unpatentability of a
  - (2) It refutes, or is inconsistent with, a position the applicant takes in:
    - (i) Opposing an argument of unpatentability relied on by the Office, or
    - (ii) Asserting an argument of patentability.

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- Individuals associated with the filing or prosecution of a patent application within the meaning of this section are: (c)
  - (1) Each inventor named in the application:
  - (2) Each attorney or agent who prepares or prosecutes the application; and
- Every other person who is substantively involved in the preparation or prosecution of the application and who (3) is associated with the inventor, with the assignee or with anyone to whom there is an obligation to assign the application.
- Individuals other than the attorney, agent or inventor may comply with this section by disclosing information to the (d) attorney, agent, or inventor.

### MERCHANT & GOULD P.C.

### **United States Patent Application**

### COMBINED DECLARATION AND POWER OF ATTORNEY

As a below named inventor I hereby declare that: my residence, post office address and citizenship are as stated below next to my name; that

I verily believe I am the original, first and sole inventor (if only one name is listed below) or a joint inventor (if plural inventors are named below) of the subject matter which is claimed and for which a patent is sought on the invention entitled: A SINGLE-CHIP CMOS DIRECT-CONVERSION TRANSCEIVER

The specification of which  a.  is attached hereto  b.  was filed on February 8, 2  PCT-filed application) described a  September 27, 2000 (if any), which	and claimed in international no	09/762,720 and was amended on o. PCT/US99/20792 filed Septembe hich I solicit a United States patent.	(if applicable) (in the case of a r 10, 1999, and as amended on	ı
any amendment referred to above a acknowledge the duty to disclose of Federal Regulations, § 1.56 (at linereby claim foreign priority beinventor's certificate listed below late before that of the application no such applications have been such applications have been	e information which is material tached hereto).  The fits under Title 35, United Solution and have also identified below on the basis of which priority seen filed.	of the above-identified specification,  I to the patentability of this application  States Code, § 119/365 of any foreign any foreign application for patent of is claimed:	on in accordance with Title 37, Con application(s) for patent or	Code
<u>∮</u> ≟ ∬ FORE	IGN APPLICATION(S), IF ANY,	CLAIMING PRIORITY UNDER 35 USC	§ 119	7
EOUNTRY	APPLICATION NUMBER	DATE OF FILING (day, month, year)	DATE OF ISSUE (day, month, year)	
ALL FORE	GN APPLICATION(S), IF ANY, I	FILED BEFORE THE PRIORITY APPLIC	CATION(S)	
COUNTRY	APPLICATION NUMBER	DATE OF FILING	DATE OF ISSUE	1

I hereby claim the benefit under Title 35, United States Code, § 120/365 of any United States and PCT international application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code, § 112, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, § 1.56(a) which occurred between the filing date of the prior application and the national or PCT international filing date of this application.

(day, month, year)

(day, month, year)

U.S. APPLICATION NUMBER	DATE OF FILING (day, month, year)	STATUS (patented, pending, abandoned)

U.S. PROVISIONAL APPLICATION NUMBER	DATE OF FILING (Day, Month, Year)
60/099,723	10 September 1998

I hereby appoint the following attorney(s) and/or patent agent(s) to prosecute this application and to transact all business in the Patent and Trademark Office connected herewith:

Albrocht John W	Don No. 40 491	Language Chairtanhan I	D. M. 41.040
Albrecht, John W.	Reg. No. 40,481	Leonard, Christopher J.	Reg. No. 41,940
Ali, M. Jeffer	Reg. No. 46,359	Liepa, Mara E.	Reg. No. 40,066
Anderson, Gregg I.	Reg. No. 28,828	Lindquist, Timothy A.	Reg. No. 40,701
Batzli, Brian H.	Reg. No. 32,960	Lycke, Lawrence E.	Reg. No. 38,540
Beard, John L.	Reg. No. 27,612	Mayfield, Denise L.	Reg. No. 33,732
Berns, John M.	Reg. No. 43,496	McDonald, Daniel W.	Reg. No. 32,044
Black, Bruce E.	Reg. No. 41,622	McIntyre, Jr., William F.	Reg. No. 44,921
Branch, John W.	Reg. No. 41,633	Mitchem, M. Todd	Reg. No. 40,731
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Bruess, Steven C.	Reg. No. 34,130	Nichols, A. Shane	Reg. No. 43,836
Byrne, Linda M.	Reg. No. 32,404	Parsons, Nancy J.	Reg. No. 40,364
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Caspers, Philip P.	Reg. No. 33,227	Phillips, John B.	Reg. No. 37,206
Chiapetta, James R.	Reg. No. 39,634	Prendergast, Paul	Reg. No. 46,068
Clifford, John A.	Reg. No. 30,247	Pytel, Melissa J.	Reg. No. 41,512
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### § 1.56 Duty to disclose information material to patentability.

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- (a) A patent by its very nature is affected with a public interest. The public interest is best served, and the most effective patent examination occurs when, at the time an application is being examined, the Office is aware of and evaluates the teachings of all information material to patentability. Each individual associated with the filing and prosecution of a patent application has a duty of candor and good faith in dealing with the Office, which includes a duty to disclose to the Office all information known to that individual to be material to patentability as defined in this section. The duty to disclose information exists with respect to each pending claim until the claim is canceled or withdrawn from consideration, or the application becomes abandoned. Information material to the patentability of a claim that is canceled or withdrawn from consideration need not be submitted if the information is not material to the patentability of any claim remaining under consideration in the application. There is no duty to submit information which is not material to the patentability of any existing claim. The duty to disclose all information known to be material to patentability is deemed to be satisfied if all information known to be material to patentability of any claim issued in a patent was cited by the Office or submitted to the Office in the manner prescribed by §§ 1.97(b)-(d) and 1.98. However, no patent will be granted on an application in connection with which fraud on the Office was practiced or attempted or the duty of disclosure was violated through bad faith or intentional misconduct. The Office encourages applicants to carefully examine:
  - (1) prior art cited in search reports of a foreign patent office in a counterpart application, and
- (2) the closest information over which individuals associated with the filing or prosecution of a patent application believe any pending claim patentably defines, to make sure that any material information contained therein is disclosed to the Office.
- (b) Under this section, information is material to patentability when it is not cumulative to information already of record or being made of record in the application, and
- (1) It establishes, by itself or in combination with other information, a prima facie case of unpatentability of a claim;
  - (2) It refutes, or is inconsistent with, a position the applicant takes in:
    - (i) Opposing an argument of unpatentability relied on by the Office, or
    - (ii) Asserting an argument of patentability.

A prima facie case of unpatentability is established when the information compels a conclusion that a claim is unpatentable under the preponderance of evidence, burden-of-proof standard, giving each term in the claim its broadest reasonable construction consistent with the specification, and before any consideration is given to evidence which may be submitted in an attempt to establish a contrary conclusion of patentability.

- (c) Individuals associated with the filing or prosecution of a patent application within the meaning of this section are:
  - (1) Each inventor named in the application:
  - (2) Each attorney or agent who prepares or prosecutes the application; and
- (3) Every other person who is substantively involved in the preparation or prosecution of the application and who is associated with the inventor, with the assignee or with anyone to whom there is an obligation to assign the application.
- (d) Individuals other than the attorney, agent or inventor may comply with this section by disclosing information to the attorney, agent, or inventor.

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